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KING GEORGE THE SIXTH SOUND

ALFRED STEPHENSON AND THE REV. W. L. S. FLEMING

Meeting of the Society, 21 February 1938: publication delayed for completion of map following p. 232

THE British Graham Land Expedition had left England in September 1934, and arrived at Port Lockroy in January 1938. Owing to engine trouble in the *Penola*, our first base had been made in the Argentine Islands in 65° 15′ S., much farther north than we had intended to winter, and our attempts to get south had been baulked very early in the Antarctic spring of 1935, for by the end of September rotten ice in Marin Darbel Bay prevented any sledging in or south of that district. Our first year's survey had therefore been limited to a strip of coast-line some 70 miles long (and neighbouring islands) from the Argentine Islands down to Cape Evensen. But in February 1936 we had moved our base 200 miles farther south to the Debenham Islands in Marguerite Bay, and were in completely new country, eager to make a flight to the south to see whether Casey Channel was going to be an easy way through to the Weddell Sea. Waiting for a flying day in the Polar regions in the summer-time is tantalizing. One must have a clear sky, and with our machine we liked to have ¾ mile of open water free from ice from which to take off. Quite often such an open space could not be seen from the base, so the plane was towed out to sea until we found a clear patch, long enough in the direction of the wind. Soon after the *Penola* had sailed for the north we were fortunate in getting a really beautiful flying day with not a cloud in the sky and numerous stretches of open water.

On this 13 March 1936 Hampton and Stephenson took off from the base at 11 a.m. and after 20 miles left the ice-strewn water and came suddenly over a dazzling sheet of bay-ice stretching to the south apparently unbroken. To the east the coast appeared absolutely continuous, and seemed to swing round in front of us to the south-west. To the west, the mountains of Alexander I Land stood out very clearly against the blue sky. Owing to an oil leak, we had to turn after flying about 80 miles south of the base. From this turning point the mountains seemed continuous right round the bay, with ranges up to

8000 feet in height stretching far to the south. There was a break in this mass which looked like a rift, but we could see no outlet at sea-level.

There was much conjecture where Casey Channel and Stefansson Strait might be, and as to what we should do. It seemed now that one sledge party would have to go round the north end of Alexander I Land to Charcot Island, and another would have to make a survey right round Marguerite Bay, while in the summer an attempt would be made to cross Graham Land. Before making final plans however there would be time for another flight in the spring, when greater distances could be covered and ice conditions studied.

The freeze up was delayed by strong winds, but early in May, after a final clearing out of all the loose ice, the sea froze, and left a wonderful winter aerodrome. Not until August was the light good enough to make a longer flight worth while. The main object of the first flight, on August 15, was to go round the north end of Alexander I Land to see if the ice was suitable for sledging, and if there were useful islands for camping. Rymill and Hampton found conditions unsuitable for sledging, but what was far more important they found the entrance to a strait which, at the most, was 30 miles wide and narrowed considerably to the south.

Next day Hampton and Stephenson set out to fly down this strait, but again bad visibility prevented us seeing the end; we found it ran slightly east of south and was between 10 and 25 miles wide. We were surprised of course that we had missed it when we flew south in March, but then we were well east of its mouth, which comes into Marguerite Bay obliquely, so that from our March position the sides appeared to merge. There was no open water to mark the entrance, and the mountains were then completely ice covered and dazzling white.

Now, in mid-August, the sledging season was at hand. It had been decided that two parties should set out, one of Rymill and Bingham, the other of Bertram, Fleming, and Stephenson. We would try to make another flight before we started, but failing that, both parties would go down the strait and divide as soon as opportunity offered. We thought it probable that the strait would turn east or west fairly soon, and from all previous reports Alexander I Land was only about 50 miles long.

Bad weather held up both sledging and flying until the end of August, and September 4, the very day we had decided to start sledging, was suitable for flying and to delay one day for reconnaissance by air was well worth while. Hampton and Stephenson were able to fly 40 miles into the strait and confirmed its general direction south 10° east. The main Graham Land coast was continuous the whole way down without sign of a break or even a low valley, and from where we turned it continued south, to a high, dark promontory of rock.

An 8000-foot range of steep-sided mountains formed the east coast of Alexander I Land. Towards the end of our flight this range decreased in height and, probably 20 or 30 miles away, finished in a low cape, which seemed to be the end of Alexander I Land. We thought it worth while for two parties to come thus far, and then separate. In the entrance to the strait numerous leads and cracks of open water ran right across. Though they looked narrow from the air, they were more than wide enough to stop sledging.

To find a feasible route on our way back we studied the col in the ridge separating the sound from the Wordie Shelf Ice. We flew low over the shelf-ice too, and Stephenson sketched what looked like the best way through the rifts and crevasses. Notes and sketch-maps were written up that night when we got back, and early next morning five sledges left the base with food and gear for eight weeks on full rations.

We planned to travel together down the Sound, and at the end of Alexander I Land, Rymill and Bingham were to go west in an attempt to reach Charcot Island and trace the mainland coast to the limit of the Dependencies, while Fleming, Bertram, and Stephenson were to continue south and turn east should they find a channel.

At first we were in country well known to us, but for eight days saw very little of the land, and kept on a compass course for 60 miles, past the Terra Firma Islands and just west of Cape Berteaux, after which we ran parallel to the edge of the Wordie Shelf Ice.

At places the shelf-ice is almost unnoticeable from sea-level, for it has only an 18-foot cliff, often drifted up with snow to a gentle incline. From the air however we had seen that in many places these harmless-looking slopes led only to the top of a large berg, broken off from the main mass and separated by a large rift. These bergs and rifts in places extended landwards more than a mile from what appeared to be the edge of the barrier. It was essential therefore that we should find the place which, from the air, seemed to afford the easiest way up to the barrier. Even to use this route we needed good visibility, and we were held up for eight days with visibility nil. To travel by compass in this maze of rifts was impossible. So we did not reach the back of the shelf-ice until September 23, 18 days from the base, and still had to find our way over the col and down the other side before we could start our exploration of the Sound. With only five weeks' food left we should not get very far, and plans were once more changed. Rymill decided that he and Bingham should reinforce our supplies so that we had a full eight weeks' rations; they would return to the base and make a fresh start easier by flying stores in to a landing ground we had found at the back of the barrier.

The steepest part of the rise to the col was the first 700 feet, and we got all the loads up to this height before they left us for the base, and we continued uphill but southwards with a new lease of life. Again we had bad visibility, but by making a fresh trail each time, we were able to relay our half-loads slowly to the top of the col, and went on with only a hazy mental picture of what one of us had seen from the air three weeks before. On September 30 it cleared and a few hundred yards ahead and east of us was a very steep drop to a much-crevassed glacier running northwards into the shelf-ice we had just crossed. To the right of our course however there was a slight rise, which we climbed, and could see quite distinctly the mass of red rock remembered as marking a possible descent from the glacier to the shelf-ice.

Next day had a blue and cloudless sky, and we raced down slopes of wind-driven snow, doing 25 miles that day, and called a halt well satisfied that we should not have to go back the next day and get the other half of our loads. For most of the way we had travelled over ice-covered hills, but on approach-

ing the rock promontory which ran into the Sound we had to cross a glacier with numerous crevasses well covered with snow bridges.

We were now in a position to start mapping the Sound, and as October 2 was fine we made it a "survey day." This meant that Fleming went off geologizing while Stephenson, with Bertram's help, did an astronomical fix and rounds of angles to outstanding mountains and points. The country east of the Sound was like that farther north, with glaciers and promontories stretching inland as far as we could see. The coast on the other side was very different, a solid wall of mountains rising to some 8000 feet. It was not a broad range with summits some distance inland, but a steep-faced ridge parallel to the shore, from which it rose abruptly. There were a few foothills and bays of ice, but behind, just a sheer wall of bare rock or slightly less precipitous ice-covered wall. The skyline was scalloped here and there, allowing icefalls to pour from the interior.

From this camp of October 1 and 2, which was about 1200 feet above the sea, we got down to the shelf-ice of the Sound without much difficulty. Most of the crevasses were well bridged, but on one occasion we nearly lost a sledge.

We were some miles south of its northern edge, but the ice was greatly disturbed by glaciers pushing into it, and was a mass of hummocks interspersed with rifts and depressions. Some of these rifts had walls 30 feet deep, and were probably half a mile wide, while others were just a few hundred feet wide with sides drifted up with snow. In other places the ice was pushed up along the plane of the tension crack into a vertical wall. This was all quite obvious in clear weather and could easily be avoided as the banks were in places drifted up, so that one could pick a way across.

We tried travelling very slowly in misty weather, but just went round in circles. It took us three days to get clear of this disturbed area, most of which time we were lying up waiting for better visibility. One afternoon, when it cleared temporarily, Bertram went out to prospect a route across a rift and came back with the news that there was a live seal at the bottom. Since the shelf-ice must have been about 300 feet thick here, and the rift was some eight miles from the edge of the shelf-ice, it must have come over the top rather than underneath. Why it had come over the ice was never solved, but we enjoyed its liver very much, and the dogs were to enjoy its blubber for some time to come, cut into small pieces and fed to them every fourth night when they were tiring of pemmican.

Once clear of the rifts the sledging was good; we did between 20 and 25 miles a day; on either side of us was new country, and beyond us, always just hidden from view, was what we were longing all day to see. We had two tents between three of us, and took it in turns for one man to be in a tent by himself: most conveniently for the time one ration box lasted one man—twenty days on full rations. With a tent to oneself there is more room for drying wet moccasins and blanket shoes; one can sleep in the middle of the tent so that one can turn over without sending showers of hoarfrost into the top of the sleeping-bag. Three people in two tents is not ideal, but it is more comfortable than three in one, and if necessary there is a spare tent and set of equipment. The tents were of the usual double pyramid type. Our

rations were based on those used by Watkins in Greenland 1930–31 ('Hints to travellers,' vol. II, p. 63). The daily ration for one man was: biscuits 2·7 oz., cocoa 0·8, oats 2·0, chocolate 2·4, pemmican 5·6, sugar 3·2, yeast 0·4, milk powder 1·6, margarine 5·6, pea flour 1·6, making a total of 25·9 oz., with 1 tablespoonful of concentrated orange juice and 1 Adexolin capsule (halibut oil).

The paraffin ration was 1 gallon for 1 tent for 10 days, which was enough for cooking, for drying footwear and gloves each evening, and to burn a low flame on days when we were lying up. This sounds luxurious, but we found it paid, for when lying up we were sufficiently comfortable to write up and think about our scientific notes and to work out all our astronomical observations. Each morning when we turned out with dry footwear and dry gloves we could get down to work with a speed impossible had we felt cold, or had we been forced to put on stiff and frozen gloves.

The time that it takes to get away in the morning depends a good deal on the surface. If it is a dry hard surface it is easy work, and one can run from sledge to tent carrying quite heavy loads. As the gear is handed out of the tent it can be thrown down anywhere without fear of filling the package with loose snow. On the other hand, in deep soft snow, carrying boxes from the tent to the sledge is very laborious, and each package that comes out of the tent has to be placed down carefully the right way up in the snow. When one gets to know the dogs, a lot of time can be saved in the mornings by chaining up to the sledge overnight those that are apt either to chew their harness and traces or to wind their traces into a ball.

As we continued southward, fresh promontories would loom up on the east of the Sound, and to the west the "last point" remained as far ahead of us as ever. Expectantly we approached and passed promontories on our left, wondering whether we should suddenly come upon the mouth of a channel running eastwards. There had been no sign of Casey Channel or Lurabee Channel, and now, as we approached and passed lat. 71°, there was no sign of Stefansson Strait; the coast line ran continuously towards the south.

Our routine at this stage of the journey was to get up at 6, and usually we had had our breakfast, struck camp, loaded the sledges, and harnessed the dogs by 8.15 or 8.30. We then travelled for two to two and a half hours before stopping to disentangle the traces and give the dogs a rest, after which we would go on until one o'clock when we took an hour off for lunch. We aimed at getting eight hours sleep each night, which meant going to sleep at 10 p.m. To do this, and write up our notes each night, we had to stop sledging at 5 p.m. When we had finished supper and written our personal diaries we still had plenty to do. The day's course had to be plotted and a rough map made from the bearings. All sketches, which on some days were quite numerous, had to be pencilled in with a heavier line, as during the day, when one's fingers are very cold, it is impossible to draw lines sufficiently hard to remain clear for any length of time. Fleming always had to write up the glaciology and geomorphology; Bertram was doing odd repairs to harnesses, skis, or personal clothing, for which Fleming and Stephenson had not the time.

By October 16 we had reached lat. 71° 30′, where the Sound narrows down

to about 10 miles. This constriction caused the ice to pile up somewhat, so that most of the time we were climbing gradually with never a really good view ahead. For many days we had wondered what lay beyond that large mass of mountains, and had sledged eagerly up every slope, but on arriving all we had seen was yet another slope. On this day we really got to the top, and at last saw something new. No longer did the east shore continue just as far as the next promontory, but instead it changed into broad sweeping glaciers, with only isolated mountains here and there; and, biggest change of all, it began to curve round in front of us.

On the 19th we went on to lat. 72°, from which position we decided that two more days would give us very little more information, and as we were already two days beyond our scheduled time for turning back we very reluctantly decided to stop. Not more than 10 miles ahead of us were some rock outcrops marking the edge of the shelf-ice and the mainland. From the last rock exposure the Graham Land coast was completely glaciated and crevassed, and ran for some 50 miles slightly west of south before disappearing from sight.

On the opposite side of the Sound, the coast of Alexander I Land could be seen almost as clearly as that of the mainland, although it was more distant, and this coast also swings westwards and terminates in a rocky mountain mass fringed by a long, low tongue of ice running apparently south-west and reminiscent of the wide stretches of low glacier-ice which form the western parts of Antwerp and Adelaide Islands farther north. From our viewpoint, this tongue of ice formed the end of Alexander I Land. Between it and the clearly defined shore of the mainland coast there was a level expanse, formed presumably of the same type of smooth unbroken shelf-ice as that on which we were camped. The air was so clear that we could have seen any high land in this direction if such existed within 50 or perhaps 80 miles and, as no such land was visible, we knew at least that for over 50 miles to the west no part of Alexander I Land extends south of the glaciated point at which we were looking. It is thus probable that Alexander I Land is an island but an island some 300 miles long instead of only 50. How far west this island extends is still unknown.

We had pitched our tents with the doors facing the setting sun. The view we got must be as clearly impressed on our memories as any we saw in the course of the expedition, for while we cooked and ate our supper we left the sleeve doors of our tents rolled up and looked into the distance, wishing that we need not turn for home, but not without a sense of satisfaction that we had had the good fortune to see where the Sound was leading and to find the westward trend of the two coast-lines which we had followed south for so great a distance.

A return journey has never the same exhilaration as the outward one, but for us it was not in every sense an anticlimax; there were still the stratified rocks on the western side of the Sound to be examined. As we had seen these at a distance all the time we were travelling south down the Sound, we were all the more anxious to find out what the rocks might be and whether they would yield any fossils by which to date them. The plan which Stephenson

Setting up the Southern Base on Barry Island

Rifts in the Wordie shelf-ice: looking south-west to Mount Edgell (left) and distant summits of Douglas Range

Aeroplane on skis for first winter flight, 15 August 1936

Igneous rocks on east coast of Sound, 1 October 1936

Pressure mounds on floor of ice-caldera, King George VI Sound

had drawn up for our return journey allowed of two full days to be spent studying these rocks.

The night spent at our most southerly camp was appropriately enough one of the coldest of the journey. The temperature fell to −22° F., and was still several degrees below zero when we started off at 8.30 the following morning; but with the advancing season the effects of the higher sun were becoming daily more apparent, not only in the warmer midday temperatures but also in the more intense sunburn which we felt, and now, heading north, we had the sun in our faces instead of at our backs. We followed our old track for the first 22 miles and then diverged westwards, slanting across the Sound towards the shore of Alexander I Land. In another two days we landed on the island in lat. 71° 15′, and pitched our camp close to the foot of a stratified rock cliff which could be approached by a smooth snow slope. We were the first to land on this island, although it had been discovered over 100 years before by Bellingshausen, who sighted its northern shore from out at sea and named his discovery after the then reigning Tsar. Close to our tents were moraine boulders sticking up above the snow, and while Stephenson and Bertram pitched the tents, Fleming started picking at the rocks in the boulders. They were mostly limestones, and it was satisfactory to confirm our belief that the rocks were sedimentary and not, as conceivably might have been the case, a series of stratified lava flows and ashes. However, as yet there were no signs of fossils.

Next morning after an early breakfast we were off on a fossil hunt, armed with hammers. When once we reached the screes at the foot of the cliffs we chipped at the dark shales but could see nothing remotely resembling a fossil. Then a slab of rock was broken in which there was a vague and faint impression which, with the aid of some imagination, might be a shell impression. On the other side was a nearly complete cast of a shell about which there could be no question. After this we found quite a number more, mostly rather ill-preserved fragments of shells, but also a few plant remains including one specimen of Ptilophyllum which, on being brought home for examination, has proved analogous to plants of that genus collected by Nordenskjold's expedition over 400 miles farther north, near the very northern end of the Graham Land peninsula. These plants indicate that the beds in Alexander I Land are of the same age as those farther north, Middle Jurassic. In all, forty-eight specimens were collected at this camp, which we named Fossil Camp.

It was by far the most interesting day's geological work since the Expedition had left home, for hitherto the rocks which we had studied had been of somewhat monotonous similarity. All along the west coast of Graham Land, throughout the whole distance of 400 miles which our Expedition had explored between the Argentine Islands and the moraines on the east side of the Sound, we had seen nothing but eruptive rocks all like those of the Southern Andes, and a few outcrops of a much older and recrystallized formation comprising gneisses and schists. It was refreshing now to find a completely different formation and to have the joys of a successful fossil hunt.

Next day we were to move on, keeping close to the shores of Alexander I

Land. This day was also to bring us new discoveries of a different kind. Six or seven miles from camp the surface of the shelf-ice, normally smooth and level, began to rise at a gentle gradient, at the top of which Bertram had stopped his team. We soon came up to him and looked into a bowl-shaped basin, nearly a mile across, bordered by ice-cliffs 100 feet high, at the edge of which we were standing. In the bottom of the depression were several mounds of angular ice-blocks piled up to a height of 30 or 40 feet above the general level of the floor. Between these stacks of ice-blocks the basin was paved with a number of mounds a few yards across, each consisting of slabs of cracked ice tilted upwards to meet in a point. It was as if a hollow domed-shaped hemisphere of ice had fallen inwards and in order that the ice might adjust itself to the smaller surface area of the floor of the basin, it had cracked and in places had been broken and pressed upwards to form the stacks. The appearance was not unlike a miniature in ice of the ruins of a volcanic mountain whose centre has collapsed and fallen inwards to form a caldera. For this reason the term Ice Caldera seemed appropriate for these peculiar and, so far as we know, unique ice forms. We saw several more such ice calderas in the Sound, but the one described is the largest. The basins are quite isolated, bear no apparent relation to the point of entry of glaciers flowing in to the shelf-ice from either side of the Sound, nor are they connected with other pressure areas within the shelf-ice. It may be that the shelf-ice on its northward flow passes over some hidden islands or projecting points of the floor of the Sound. It seems more probable however they are analogous to certain down-faulted basins within rift-valleys, and are due to lateral pressure.

At about this time the dogs were becoming noticeably bored, particularly during the afternoon of each day's sledging. This was to be expected on any long period of hard work without fresh food, but it seemed to be increased by the monotony of pulling continuously over a perfectly level featureless surface. The ice calderas proved of some interest to them, but they were far more excited the next day by a belt of pressure ice which we encountered a mile or so from land, as we approached the coast of Alexander I Land once more, there to spend our second day in studying the rocks. This pressure ice was disposed in a series of parallel ridges, and on reaching them the teams broke into a gallop over the glazed surface of the rolling ice. Ski-ing was impracticable, so we tied our skis to the sledges and rode on them, jumping off to guide and balance them wherever necessary.

Soon we came to a level place close to land where we could camp. All the superficial snow and ice had been thawed away, and we pitched our tents on hard glazed ice, without even enough snow to pile on to the skirts of the tents for anchorage. This surprising amount of thaw is due to the black specks lying everywhere on the ice. The adjacent rocks, or at all events some of them, are broken up by frost action into a fine dust, which is distributed over the ice by the wind and absorbs the sun's rays to cause excessive melting. Our camp was half a mile from a valley, at one time glaciated, but now bare of ice, save for one or two stagnant decaying remnants, so we named it Ablation Camp. On the following day we were walking on scree blocks set loosely in a dry powdery dust, or on the mingled boulders, gravel, and clay of

moraine ridges that indicated the former extent of the glaciers. On some of the rocks were lichens, but we could find no patches of moss which occur on many of the snow-free parts of the land farther north. It was a pleasant change to be on land once more, though it caused as much wear to our sealskin boots as the rest of the journey put together. This camping place was a geologist's paradise, and to spend only a single day was tantalizing, even though it was obvious we could afford no longer. Here we found more fossil plants and shells, the latter mostly lamellibranchs and brachiopods, but in addition a few belemnites which we had not found at our previous camp, and a tooth of the shark Hybodus. All these witness to a period when the climate of the west Antarctic was much milder than it is to-day and to a reasonably luxuriant vegetation. It would not have been surprising had we seen coal, and search in Alexander I Land may well reveal it.

The glacial features were unusual. The bay west of our camp was filled by a maze of icy mounds up to 20 feet high, separated by lanes paved with clear smooth freshwater ice, while off the headlands there were ridges of ice arranged in waves as if a rough sea had frozen as it beat against the cliffed shores. At the back of the bay the shelf-ice had been thinned by ablation to expose a well-defined tide crack. Here was certain proof that we were on an arm of the sea and that the ice in the Sound was what it seemed to us to be: shelf-ice. And if the ice in the Sound at this point was shelf-ice, there seemed no reason to regard it as anything else throughout the entire length of the Sound, as far south as our turning point. Indeed there was a quite definite appearance of coast-lines on either side of the smooth ice with which the Sound is filled, marked by a well-pronounced increase in gradient of the ice where it spills into the Sound.

That day at Ablation Camp was as perfect a day as we could have wished for, Stephenson was able to get sufficient sights for a good station, while Bertram and Fleming looked for fossils and sketched the glacial features. By next morning it was far too stormy to travel, and we had an extra day to geologise, but it is not easy to look for fossils in a blizzard, and we added only a few specimens to our collection, which now numbered about one hundred. There was no question but that we must leave Alexander I Land for good and make the best pace we could for home. We had twenty-two days' food left on the basis of making a ration box last twelve days in place of ten, and we had to cover a distance which had taken thirty-two days on the way out. On the outward journey we had been held up by poor visibility for a great many days, and there were no good grounds for expecting any better weather on the homeward trail. Our first obstacle was the rifted part of the shelf-ice ahead, and we hoped to cross this in a clear light. But unfortunately on the morning when we approached the rifts high clouds began to develop and rapidly the light grew faint. At 12.45 Bertram had to stop his sledge, for the ground was beginning to fall away in front of him and he and Stephenson went ahead to prospect, while Fleming stayed with the sledges to look after the dogs. They were ski-ing down what they thought was the drifted side of a rift, and were convinced they had reached the foot. The next moment they fell 30 feet and landed luckily in a soft bank of snow.

This incident gave us an added respect for poor light. Perhaps it would

seem folly to travel at all in such conditions, but our food supply would not allow of too much caution, and though we had several lying-up days whilst we were amongst the rifts, we travelled whenever it was at all possible. On one such day, when the light was poor, we were surprised by seeing an Adélie Penguin coming up at a good steady pace to meet us, making apparently for the South Pole, and already perhaps 40 miles from the nearest open water. Instinct, it would seem, is not an infallible guide, not at all events for penguins.

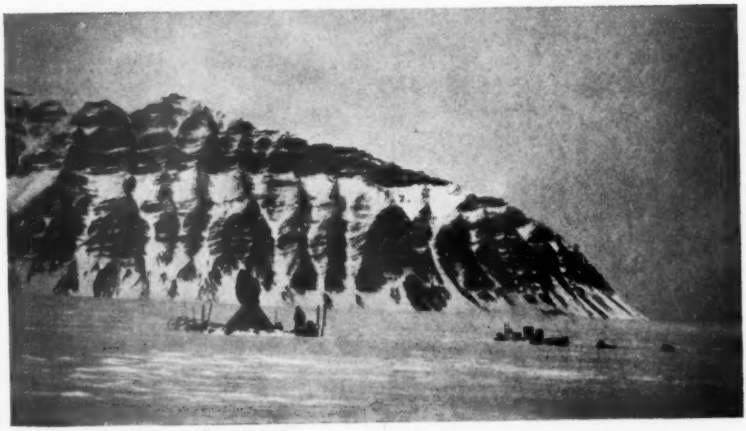
Bad visibility was not our only enemy in this difficult country, for with the days becoming warmer the hard-crusted surface of the shelf-ice had given place to a deep soft snow. Our skis would not slide and became caked with clinging snow. The dogs were having a really hard job of it. We were not at the depot which we had left at the foot of the glacier where it joins the Sound until November 9, having taken nine days to travel 29 miles. We still had crevasses to cross on both sides of the Col, then there was still ahead of us the climb itself to the top of the Col (and if the surface did not improve that would take several days), and finally we had to negotiate 50 miles of sea-ice, the state of which we could only conjecture. Now we had ten days' food left on reduced rations to take us to Terra Firma Islands, where we knew a depot would be lying for us, and on the outward route this distance had taken us more than twice that time.

This weather was really becoming desperate, and when we camped beyond the crevasses we had covered only four miles. It was therefore a welcome surprise to wake next morning and find a cloudless sky. At last we were sledging in sunshine and the pull up the glacier to the Col was easy work for the dogs, for our loads were light and the surface had been hardened by colder temperatures. Shortly after midday on November 11 we were at the top of the Col enjoying the view, our last good view of King George VI Sound. On its farther side was the mountain front of Alexander I Land, which must be one of the most impressive ranges in the world. In the clear light the steep summit of the range, scalloped into a series of high corries, stood out plainly, whilst beneath were irregular foothills traversed by glaciers. Just as we were ready to be on the move once more and planning the best route across the summit of the Col, we saw two black specks moving in the distance, which resolved themselves into Rymill and Bingham with two sledges and dog teams, and half an hour later we were exchanging greetings and hearing a condensed account of all the news since we had been away.

The remainder of the Expedition had been faring well, but from the outside world came one piece of news about which we felt the deepest concern, for at this spot we heard of the death of J. B. Charcot, who was the pioneer of the country we were in and who had been an enthusiastic friend to our Expedition. Rymill and Bingham left the half-loads which they had been taking to the top of the Col and turned back to their camp half-way down the glacier. We spent a night together in camp, and then Rymill and Bingham went off up to the Col with the second half of their load while we continued home. The meeting had been opportune, for we were able to confirm what the other two had already learnt from a flight, that to attempt to travel westwards towards Charcot Land would be impracticable unless they could be out twice the time

Looking west from Sound towards Ablation Camp

Near Ablation Camp, 25 October 1936



Sedimentary rocks on west coast of Sound, 24 October 1936

At Red Rock Ridge, returning from the Sound

Cape Nicholas and northern Alexander I Land, looking west by north, 1 February 1937

that we had been away, for first they would have to follow our route down the Sound to where we turned. So they decided to push eastwards, and eventually succeeded in crossing Graham Land to the Weddell Sea.

The day we separated the weather was again fine and in the good light crevasses were easily negotiated because they were easy to see. In an hour's time we were down on the shelf-ice that now fills the south-east corner of Marguerite Bay, but, as the climate seems to be getting milder, may before long be carried out to sea in the form of large tabular bergs.

Two fine days of travelling took us to the Terra Firma Islands, where we picked up a depot left for us by Hampton and Riley, and after meagre rations could enjoy an orgy of porridge, margarine, and chocolate. From the Terra Firma Islands home, a distance of about 35 miles, the journey was uneventful. The sea-ice had begun to thaw but was still quite solid and did not break out for another two months. Occasionally we passed a Weddell seal lying out on the ice with her pup, or an inquisitive penguin, determined to see a dog-team at close quarters but never surviving to tell the tale. At Red Rock Ridge, 10 miles from the base, we were surprised to find a large rookery of Adélie penguins: surprised because the nearest open water must have been 40 or 50 miles away and the birds had walked this distance over the sea-ice to reach their nesting-place. From our point of view they could not have chosen a more admirable site, for they provided us with about 1200 eggs, and at the rookery we first met Hampton and Meiklejohn, who had sledged over to collect them. The same afternoon we were back at the base far earlier than conditions of a week before had led us to expect, for there had actually been five consecutive fine days, a record for the trip.

The dog teams raced the last part of the way home, for instinct told them what was in store. They revelled in blubber for the next week, ate it all day and slept in it at night, and their nice clean shaggy coats were soon a sticky mess of matted hair. They must have been thankful for a rest, and full well they deserved it. They had been our constant companions for the ten weeks of the journey, and many of these dogs were known to us from the day they were born. They had done their work admirably. Why or how it is that dogs will consent to sledge on for mile after mile when they can sense little of the thrills of new discovery, when they have to sleep out in all weathers, licking the snow for drink and having to be content with one meal a day which takes less than a minute to consume: how they do all this is difficult to understand. But they do it and are in large measure responsible for the success of a sledge journey in which they play so important a part. It is invidious to single out any dog or dogs from a number so varied in character and so different in qualities, and each driver has a natural tendency to favour the dogs of his own team, but there is one that does deserve a special mention: the leader of Bertram's leading team, Lamb. One could completely forgive her habit of singing in the middle of the night because of her amazing keenness when sledging and her outstanding aptitude for steering straight. Bertram and Lamb certainly understood one another, and the result was most successful.

The most vivid and enjoyable days in Graham Land were not those spent at the base, not even after a long journey when one was revelling in the luxuries of a hot bath and a shave, of scrambled penguins' eggs and the comfort of a

warm bunk. The best days were those of sledging in unknown country—untouched, unspoiled, as God had made it. The interest of wondering what is round the next corner, the stimulus of discussing the origin of newly discovered land or glacial features, the companionship of the dogs, and most of all the close friendship which sledging establishes amongst the members of the party: these are some of the delights of a sledge journey, enhanced by the invigoration of feeling fit, and without the distractions and artificialities of civilized life. There will assuredly be other sledge journeys down King George the Sixth Sound, for this would seem to be the gateway to wide tracts of unknown land beyond, to the greater part of unexplored Western Antarctica. The very existence of this route suggests the work for future expeditions; one hopes that they may be organized in this country and sponsored by this Society.

DISCUSSION

Before the paper the President (Professor HENRY BALFOUR) said: The most important discovery made by the British Graham Land Expedition was a great ice-bound waterway between Alexander I Land and Graham Land. His Majesty the King, our Royal Patron, has graciously consented to his name being given to this geographical feature which will be known henceforth as King George the Sixth Sound.

We are to hear about that Sound to-night from Mr. Stephenson and Mr. Fleming, who both took part in the Antarctic adventure of its discovery and exploration. Their sentences will not run concurrently. Mr. Stephenson will lead off, and at a certain stage there will be a change in the voice, when Mr. Fleming takes over.

Mr. Stephenson and the Rev. Launcelot Fleming then delivered the lecture printed above, and a discussion followed.

The PRESIDENT: The leader of the expedition is present this evening. I will ask him to supplement the account given by his colleagues.

Mr. JOHN RYMILL: We have listened to-night to a straightforward account of a piece of work well done. That it would be well done I had never doubted. When Bingham and I returned from the shelf-ice, leaving Stephenson, Fleming, and Bertram to carry on down the strait, I had complete confidence in the man I left in charge, and knew he would be well supported by his two companions. When Stephenson took command of this particular journey he had already four winters' and six summers' experience in the polar regions, and therefore you have heard nothing of the excitements and adventures of a journey born of ignorance. I do not think there is anything else I can with advantage add to what Stephenson has already told you.

Dr. H. R. MILL: The main interest of this Society in the past in hearing accounts of Antarctic expeditions has been in welcoming a great commander like Scott, an inspired leader like Shackleton, or a single-hearted adventurer like Amundsen. But on this occasion we have had the confirmation of a phrase used very aptly by our President in referring to the expedition as an expedition of colleagues. And Rymill has shown the thoroughly modern and most comrade-like method of exploration by a group of men of equal intelligence, equal information and power, each in his own particular department, working together as a most harmonious team. It is not often that a leader gives equal prominence to the work of his subordinates as he does to his own. I think we may congratulate

these very modest gentlemen as Antarctic explorers of the best and most recent type.

I want to ask one question, and to add my aspirations to one hope. The question I want to ask is whether any determination was made of the height above sea-level of the shelf-ice. I must confess that the term "shelf-ice" rather jars upon my mind, because I can never remember the definition of it. I have been so accustomed to think of the surface of the barrier in the Ross Sea, which is now spoken of as the Ross shelf-ice and which has a height of something like 150 feet above sea-level, that when shelf-ice is referred to I wonder whether it is also of that approximate height above sea-level or whether it is more in the nature of an ice-foot.

The hope I want to add my aspirations to is that this opening into the unknown Antarctic will be followed up speedily, and by another British expedition under the auspices of our own Society.

Sir ALBERT SEWARD: I am very glad to have the opportunity of expressing my own great enjoyment of what I have heard this evening; not only because of the interest of the subject-matter but, if I may say so, because of the exceptionally delightful way in which the account of the journey was put before us by both speakers.

It has never been my good fortune to visit the Antarctic Continent. When I see such pictures as we have seen this evening, I often feel a certain satisfaction that there are in the world most impressive and most beautiful sights which the great majority of men will never see. I like to think that they are obviously not there for the enjoyment of human beings.

Mr. Fleming has told us of the discovery of fossil plants, and shown us a drawing of one. I have seen the actual specimen, and I do not think the drawing does justice to the fossil itself. Fortunately the fragment is well enough preserved for identification with a good deal of confidence. That fossil is evidence of a vegetation which could only exist, so far as one can tell, in a climate which was almost sub-tropical, I suppose, 150 million years ago. A very rich fossil flora, most likely of the same age as Mr. Fleming's specimen, was discovered about thirty years ago by the Swedish expedition of 1901–3, in, I think, Hope Bay, a few hundred miles farther north. So in Antarctica and on Alexander I Land there was, at one time, a vegetation which tells us of an enormous change in climate. These fossil plants found in Antarctica agree very closely indeed with some plants of much the same age found a good many years ago in the Arctic; and plants very similar to Mr. Fleming's might have been found in the Jurassic rocks of the Yorkshire cliffs. His plant alone was worth hardship and a long travel, and is only one of the many results of first-rate importance brought home by this expedition. We owe a deep debt of gratitude to Mr. Rymill and to all his companions.

Mr. J. M. WORDIE: I am like Dr. Mill in finding it difficult to give up the old name of the barrier and adopt the new name of shelf-ice. I do not know that the new name is any more easy to pronounce than the old, or conveys any very different meaning. The old name of barrier has a long tradition behind it from the journeys of Scott, Shackleton, and Ross; so I hope Mr. Rymill and his companions may be persuaded not to go off on this new line and desert the old.

The discovery about which we have heard to-night is one of the great features of Antarctic scenery. We are accustomed to the Ross Barrier. There is the Beardmore Glacier, which Shackleton discovered from the top of Mount Hope, and there is the great Antarctic platform. These are the three great elements one thinks of. And now we have a rift in Graham Land which is only comparable with the division between Arctic Canada and Greenland: Smith Sound. The

region has not yet been completely mapped; one hopes that it will not be long before some of this party, or others, go down and complete these wonderful discoveries.

The PRESIDENT: Our evening has been extremely well spent; we have had a dual lecture of crystal clearness, on a feature of high intrinsic and great scientific interest.

The fact that this King George the Sixth Sound makes an abrupt dividing line between two completely different geological formations tempts one to believe that Alexander I Land is an island, but it has yet to be proved completely. A second expedition at least is wanted to give completely the configuration of Alexander I Land and its relationship to Charcot Island.

I ask you to express your hearty thanks to our two lecturers and to the leader of the expedition, who share the success of a very great adventure of more than two and a half years in the Antarctic.

GRAHAM LAND AND THE PROBLEM OF STEFANSSON STRAIT

A. STEPHENSON

Meeting of the Society, 27 May 1940

THE solution of the problem of Stefansson Strait was not one of the original objects of the British Graham Land Expedition when it left England in 1934. In the early days of the Expedition the existence of Stefansson Strait was thought to be a fairly well established fact, but at the close of the Expedition it was equally well established that there was no Stefansson Strait on the western side of Graham Land. This simple state of affairs was complicated by the various reports and publications in connection with Lincoln Ellsworth's two long antarctic flights in November 1936. It was in an endeavour to correlate the various descriptions and maps of southern Graham Land that the problem of Stefansson Strait arose; a problem which can be better appreciated if we make a short summary of the sequence of events in this part of the Antarctic.

When in January 1821 Bellingshausen discovered Alexander the First Land, he assumed that the land east of it was part of an Antarctic continent. Ten years later when Biscoe discovered the Biscoe Islands, he called the high land to the east of them Graham Land after Sir James Graham, then First Lord of the Admiralty. And so for nearly a hundred years from the time of Biscoe the charts represented Graham Land as a peninsula of the Antarctic continent. During this period the country was visited by De Gerlache, Charcot, and numerous whalers, but still there was nothing to suggest that Graham Land was not a peninsula.

In December 1928 Sir Hubert Wilkins arrived at Deception Island with the Wilkins-Hearst Antarctic Expedition, and although his major plans never materialized he made one very successful flight down the east coast of Graham Land to a point some 600 miles south of Deception Island. Previous explorers of the east coast had outlined it to about latitude 67° 30′ S., or approximately as far as Adelaide Island on the west coast. Beyond this point it was assumed that Graham Land continued until it joined the mainland. Wilkins however claimed to have discovered channels, filled with sea-ice, which broke up southern Graham Land into a series of islands, and on December 20, at 12.50 p.m., he wrote, "We are now quite certain that Graham Land is not connected with the mainland continent. Felt sure before, but at this point it could be clearly shown on a photograph."

Three such channels were reported by Wilkins, and in the map which was published to accompany his report they were named from north to south Casey and Lurabee Channels, and Stefansson Strait. To the south of the last lay Hearst Land, and east of it, for the Strait curved round from an east–west to a north–south direction, the land terminated in a point called Cape Eielson. All this was shown in detail on a map called "The Antarctic Archipelago," in which the newly discovered channels ran from the Weddell Sea to Marguerite Bay.

These discoveries seemed to confirm the report of the two gunners named Beckman and Mathisen, who were sailing south of Adelaide Island in February 1924 (G. Hayes, 'Conquest of the South Pole,' p. 250), and by 1934, when the B.G.L.E. left England, Graham Land was no longer considered a peninsula.

Previous accounts of the Expedition's work have related how and why the original intention of wintering in Marguerite Bay was not carried out in the first year. As a result, the first year's survey work was limited to a strip of coast and islands between the Argentine Islands and Marin Darbel Bay, and we obtained no further information as to the character of southern Graham Land. During the spring of the first year (1935–36) Lincoln Ellsworth had arrived off Graham Land to make a second attempt to cross the Antarctic from the Weddell Sea to Little America, this time using the long snow-covered Dundee Island as an aerodrome. Sir Hubert Wilkins, stationed on the supply ship the *Wyatt-Earp*, was in command while Ellsworth was in the air. On 21 November 1935 he flew down the East Coast beyond what he took to be Wilkins' Stefansson Strait, got into high mountainous country, and was turned back by bad weather. Two days later, on November 23, he and Kenyon made their second flight, west of the first, and after several successful landings eventually came down near Little America.

The B.G.L.E. had been in wireless communication with the *Wyatt-Earp* since she left South America, and Wilkins had promised us any information of new discoveries which might help us in our general plans. After Ellsworth had finally got away therefore we were keen to hear exactly what his course had been and what he had seen in southern Graham Land. This information was contained in the following radio-message from Wilkins: "For your expedition and private information only: Ellsworth on November 21st passed around Ross Island then direct to easternmost Finley Island then over Stefansson Strait which he saw running about thirty miles to Westward. He estimated Hearst Land coast about ten miles north of where indicated on chart. Confirms that Cape Eielson is low cape with nunataks and from there ground rises to high mountains which apparently trend N.W.–S.E. continuing down coast of Weddell Sea as far as could be seen from an elevation of 12,000 feet. This range is about 100 miles with peaks to 11,000 feet. He turned back at about lat. 72° 10′, long. 67°." On November 23 "He flew parallel previous course but was apparently 20 miles to west of it as far as lat. 72°, long. 68°, then he turned south westward to about lat. 73°, long. 72° where was over a wide valley which seemed to run north-westwards to the coast. From about lat. 73°, long. 72° he went practically straight to about lat. 76° and probably long. 83°, when we last heard his signals. Wilkins."

Thus in December 1935 we still supposed that Graham Land was separated from the continent by Stefansson Strait, and that Lurabee and Casey Channels would provide us with sea-level routes to the Weddell Sea. In February 1936 therefore, with our plans still much the same, we moved our base 200 miles farther south to the Debenham Islands in Marguerite Bay. By the time *Penola* had been unloaded and made her departure for the Falkland Islands the summer was well spent, but conditions were still suitable for a short survey flight to the south on 13 March 1936. From our turning point 75 miles south

of the second base we should have been able to see Casey Channel, but there was no sign of any channel coming through from the east, and the west coast of Graham Land appeared to swing round to the south-west and join up with Alexander Land, thus closing Marguerite Bay on its south and eastern sides. Due south from the turning point the mountains were high with steep ice-covered slopes which were so dazzling in the brilliant sun that to estimate distances was impossible. There appeared to be a big valley between two high ranges of mountains, but no outlet at sea-level. Marguerite Bay at this time was still filled with sea-ice, and it was not until five months later that we discovered that we had been looking obliquely across the mouth of quite a large channel.

Hence at the beginning of our second winter our plans were a little vague, and it appeared that sledging journeys would have to be made across Graham Land and round the north end of Alexander Land. An attempt to fit in Wilkins' discoveries as confirmed by Ellsworth, with an enclosed Marguerite Bay, taxed our ingenuities to the extreme. We wirelessed for further information, but the only new factor was that Ellsworth among other things had stated that Stefansson Strait was not more than a mile or two wide.

Although we were not aware of it, a general idea of the knowledge of the country at this time was shown in the map which accompanied Mr. Joerg's account of the Topographical Results of Ellsworth's Flight in the *Geographical Review* for July 1936. This map shows an enclosed Marguerite Bay and a Stefansson Strait on the east coast in about lat. 70° running W.S.W. At this time there had been no correlation between Wilkins' and Ellsworth's photographs, and there was difficulty in reconciling the Strait on the east with an enclosed Marguerite Bay on the west. Mr. Joerg, after referring to Wilkins' discovery of high land in 1930, and the B.G.L.E. discovery of mountains south of Marguerite Bay, says, "These discoveries might indicate that Stefansson Strait is not a strait at all but merely one of the embayments, a major one to be sure, into which the glaciers of the eastern side of Graham Land discharge."

In August and September 1936 we made further flights from the Debenham Islands to the south of Marguerite Bay, after the first of which it was realized that there was a big strait running S.S.E. between Alexander Land and Graham Land. The existence of this strait, now called King George the Sixth Sound, the discovery and survey of which have been described in the preceding paper, made it possible to consider our general plans once more. We had flown 40 miles into the Sound without having seen any sign of a channel from the east, but we felt that there was always the possibility of the Sound swinging eastwards into Stefansson Strait; or perhaps farther south the channels would join the Sound. Later the Sound was explored by sledge for some 200 miles to 72° 30′ S., but there was no sign of any of the channels reported by Wilkins, and that was stated in a report published in *The Times* on 12 December 1936.

The possibility that the channels shown by Wilkins in these latitudes existed as fjords on the east coast was dispelled by the surveys of Rymill and Bingham between November 1936 and, January 1937. They crossed the plateau in approximately lat. 69° 50′ S., and, apart from a big valley to the

north of their course, the plateau was continuous as far as they could see at a height of about 5000 to 6000 feet. When about 40 miles from the east coast they discovered a range of mountains rising to over 9000 feet (Mount Wakefield, 9400 feet), and east of the range the land fell to a lower plateau and then broke up into a series of valleys and ridges running easterly towards the Weddell Sea. From their turning point in lat. 70° 10′ S., long. 64° W. the land to the south rose to a vast flat-topped range some 10,000 feet high, and which was obviously not in the region of Wilkins' Stefansson Strait, since he made no mention of high mountains. Northwards from Rymill's most northerly point (69° 39′ S., 64° W.) the land consisted of low broken hills and was more comparable with Wilkins' descriptions, but according to Wilkins' map it was over 100 miles too far north.

The results of these two journeys of the B.G.L.E. were first plotted in Graham Land, and have since been plotted more accurately and with detail added from photographs. This map, now published, represents the extent of our knowledge of Southern Graham Land in January 1937, the major features of which were described in accounts in *The Times* of 12 December 1936 and 27 January 1937. At this time there was no feature which could have been recognized as Stefansson Strait by the B.G.L.E., yet Ellsworth was positive he had seen the feature as described by Wilkins and apparently within about 10 miles of its plotted position. Where then was this Strait which we had proved could not lie within 100 miles of that position?

In July 1937 a second paper by Mr. Joerg in the *Geographical Review* cleared up the problem to a certain extent. Adjustments had been made since 1936 and the whole of the area in question had been moved north some 70–80 miles, and in addition some of Ellsworth's photographs had been identified with those of Wilkins. The reason for this northward movement is explained by Joerg in the sentence, "The discovery referred to below, that on the two flights another cape was mistakenly identified as Cape Eielson, and other considerations, led to the north-eastward shifting of the features in this area." The mistaken identity however can only indicate the direction of movement and not the amount, since the latter depends upon knowing the true position of Wilkins' Cape Eielson: a position impossible to determine from the available data. The amount by which the second plot has been moved north therefore must depend upon the "other considerations." These considerations refer chiefly to the plotted position of the route for the flight of November 23, and the position of the east coast map is dependent upon the tie afforded by photographs of identical features taken on the two flights, November 21 and November 23.

Concerning their true position Joerg said, "The uncertainty as to the absolute position in terms of latitude and longitude of the areas shown is due to the fact that no astronomically determined points were available in the stretches of the route on which these areas were 'hung.' The areas lie along the eastern, larger segment of the November 23rd flight, whose 1600 mile length is tied down only at its end points." Ties so far apart "did not preclude individual shifts in some of its parts," adds Joerg, and as a result we find a big shift on the east coast, and on the west we find that what Kenyon described in his log as a "wide level bottomed valley which seems to run from the hinterland south

right north towards the sea" is moved some 100 miles to the north-east and becomes what Joerg calls in 1937 "The Great Fault Depression," to coincide with King George the Sixth Sound which in *The Times* of 12 December 1936 had been described as "one of the most impressive fault features of the earth's surface."

The situation in July 1937 was then that the B.G.L.E. considered that Stefansson Strait did not exist at all in the areas which they had surveyed; and that Mr. Joerg, who was responsible for interpreting the results of the Ellsworth flight, considered that it was probably only an inlet on the east coast, but was not certain where.

To study the problem it was essential for us to see the original data, and if possible to discuss them with Sir Hubert Wilkins and Mr. Ellsworth. At this point Mr. Hinks became very interested in the problem and has since devoted much time and thought to it. In very generous response to his request the American Geographical Society sent a complete set of the Ellsworth photographs, the original prints of Wilkins' with all identified points marked, and a compilation, arranged in graphic form, of all the material from the logs of Ellsworth and Kenyon, and from the latter's radio reports to the *Wyatt-Earp*. Also in the autumn of 1937 Mr. Ellsworth came to London, and we had the advantage of discussing with him his recollections of the flight. He was confident that he had identified Wilkins' Stefansson Strait, and had a clear recollection of what he took for Cape Eielson surrounded by nunataks as Wilkins described it. But he did not remember noticing the north–south passage which Kenyon had logged, though his photographs prove that it was King George the Sixth Sound. The map of this area which Mr. Joerg had constructed from them was remarkably like the map from our ground surveys. It remained to find identities between our photographs and those of Ellsworth. We had few air photographs of that part of the Sound over which Ellsworth had flown, but one picture, RA.23, showed a feature on the west side of the Sound which we called Pyramid Point and which appeared in Ellsworth's photograph E.20. Farther south, on the east side of the Sound, a ground photograph (RA.460) of the shore-line just to the north of the Batterbee Mountains, contained detail that appears in Ellsworth's photograph E.26. We easily recognized other features in Ellsworth's photographs, but we had no B.G.L.E. photographs of them. However the correlation was sufficient for us to agree with Joerg's placing of his Map B and his general Map D (*Geographical Review* July 1937).

On his Map A of the east coast most of the detail was plotted from photographs taken on November 21. This flight had been very difficult to plot because of its very circuitous course and the impossibility of reconciling times in the log. The position he finally assigned to it depended upon certain identities between photographs on November 21 and 23, and the reconstruction of the latter flight required by his placing of Map B. This put the southern limit of his Map B in 69° 35′ S. with a photograph EA.5 of November 21 on its extreme southern edge.

We studied these east coast photographs of Ellsworth's a long time before we could recognize any identity with Bingham's photographs, and eventually found that by great good fortune Bingham's RD.40, the most northerly he

took, shows the same group of small mountains as the mountains shown on Ellsworth's A.5, the most southerly which can be connected with the details of Joerg's Map A. It proves quite conclusively that the whole of Map A lies well to the north of Rymill and Bingham's route.

A second and less convincing identity was found in the pair, EA.9 and RD.85. With these two identities we tried to replot the route of the November 21 flight, but owing to the difficulties with the recorded times could do no more than sketch that part of the course which lay south of lat. 69° 30′ and included the turning point of November 21.

A part of the problem for Joerg, and for us, has been to determine how the names given by Wilkins in the diagram and sketch-map published in the *Geographical Review* for July 1929 can be applied to the features of our maps. Even if the channels do not exist there may be glaciers in their place which might bear the same name. Joerg appears to have made as sound a correlation with Wilkins as was possible from the rather vague descriptions and orientations given to Wilkins' photographs, which are untimed. It is certain that what Joerg has called Lurabee Glacier is what Wilkins called Lurabee Channel; the features on either side can be identified. It is also legitimate to call the low land south of Lurabee Glacier, Scripps Peninsula, but that is about as far as one can go in using his names. We think that the glacier immediately north of Lurabee Glacier is not what Wilkins called Casey Channel. The only positive identification is in and around Lurabee Channel. Stefansson Strait according to Wilkins should lie south of Scripps Island, and Joerg has suggested that it is the big glacier seen in photograph E.9, which is the glacier across which Rymill and Bingham were looking south from Camp S in 70° 10′ S., but the south side of that glacier is bounded by mountains rising to about 10,000 feet and Wilkins saw only low land, rising gradually, to the south of his Strait. Moreover Wilkins' photographs P and Q are labelled Stefansson Strait, and Joerg seems justified in placing them as shown on his Map A. From the description given them by Wilkins the Strait should lie between P and Q; but as the photographs are contiguous and show a continuous land mass, this is impossible and the Strait should lie in front of the land mass, which on Joerg's orientation of P and Q would seem to be the north side of the big point mapped by Rymill in lat. 69° 30′ on the east coast. In that case Stefansson Strait might be the glacier just north of the point, and the Finley Islands (Wilkins) or Peninsula (Joerg) might be the land described from a distance by Rymill as "low rounded hills."

The identity of Cape Eielson is even more doubtful: the only photograph purporting to show it, Wilkins' R (reproduced in *Geographical Review*), was, according to his sketch-map, taken soon after Q, and roughly at right-angles to it, looking about north-east. As Joerg has greatly changed the orientations of P and Q this must leave that of R very uncertain. The features shown on R are very ill defined, and remarkably like many other thousands of square miles in the Antarctic, with nothing to suggest the massive promontory which has been so conspicuous on the maps.

We conclude then that the names Stefansson and Eielson cannot with any good reason be assigned to any features mapped by the B.G.L.E.; and they are the only two of Wilkins' names which come within our surveyed area.

To avoid further confusion in future maps therefore it will be better not to give a definite location to Stefansson "Strait" or "Inlet," and for the same reason the name Hearst Land must be deleted. There is no justification for assuming that all the land between the shores of a mythical Stefansson Strait and the even vaguer "distant slopes" seen from Charcot Island by Wilkins in 1929 was one and the same stretch of land and that it should all be called Hearst Land. Lurabee and Scripps are properly assigned by Joerg to features north of it; his disposition of other names, Casey, Keeler, Mayo, Ranck, will be discussed later.

In conclusion, one may say that a major result of the B.G.L.E. has been to establish once more the peninsularity of Graham Land. Wilkins had suggested another possible break at Crane Channel in lat. 66° 37′, but this possibility was disposed of after the flight made on 13 February 1937 (see previous account of the B.G.L.E.). Thus the actual coast-line examined carefully by the Expedition stretches from lat. 65°–72° 30′ S., in which strip of coast there was no sign whatsoever of a channel coming through from the east coast at sea-level.

NOTES ON THE MAP OF GRAHAM LAND

The methods of survey adopted by the B.G.L.E. have been discussed in the *Journal* for June 1938. The greater part of this present map is based on what is there described as a "running traverse." At each astronomical station, of which there were nine on the west coast in a distance of 300 miles, rounds of theodolite angles were taken for fixing detail, and elsewhere compass bearings at almost 2-mile intervals. The continuous form-lines are drawn between triangulated heights with the help of sketches and photographs. The height of the theodolite station, when not at sea-level, was determined by aneroid, referred to M.S.L. pressure at Barry Island. Observations on sledge journeys had shown that the pressure over Marguerite Bay was fairly uniform. On the east coast it may have been different from that on the west, so that the eastern form-lines are less reliable.

Owing to the lack of well-defined recognizable points, no heights were determined in Alexander I Land south of Ablation Camp, so that the form-lines here are pecked and approximate. Similarly the height of the mountains at the southern limit of east coast survey are approximate only, since the mountains were too far away to be accurately fixed.

The running traverse applies to the whole mainland coasts, east and west, and to the east coast of Alexander I Land south of 69° 40′. The outline of the northern and western parts north of C. Nicholas is based on Charcot's map; for the rest upon air sketches and photographs. We have had to alter the positions of the mountains mapped by Charcot, to fit them to the detail of our air photographs and to the few long rays we were able to take from the east of Marguerite Bay. From the turning point of the flight of 15 August 1936 Rymill and Hampton concluded that Rothschild Island was an isolated mountain surrounded by land-ice, forming a promontory of Alexander I Land rather than an island. Photographs taken on the flights of 16 August 1936 and 1 February 1937 include all the mountains from the most northerly point, Mount Bayonne, down to the northern end of the Douglas Range. We were able to relate these photographs with the groups mapped by Charcot, by comparing them with his panoramic sketches. The feature common to both was "Les Dents," a group of four very sharp needle rocks between the Bayonne and Paris mountains.

In tracing the features eastward it appeared that Calais Mountain must be the "island" rock mass in lat. 69°, the eastern point of which we have called C. Nicholas. Charcot's Nicholas II Island we could not recognize. Judging from Charcot's panoramas I think he underestimated the distance and took for a near low island the high distant mass of Mount Edgell east of the Sound. Similarly Guernsey and Gordon Bennett Islands were probably tops of distant mountains.

At times the mountains of Alexander I Land were clearly seen by us from Barry Island some 100 miles away as clear-cut black masses well above the horizon, and at other times a dazzling white mass with no shape.

The large bay on the west of Alexander I Land was sketched on our flight of 1 February 1937. We flew at about 7000 feet from Cape Nicholas up a valley immediately west of the Douglas Range to a small ice-field at about 5000 feet, which at our turning-point, some 40 miles south of Cape Nicholas, ended abruptly, and steep glaciers flowed down into a large bay which opened out to the west. The south side of the bay was indicated by a long rock-scattered icy ridge running out to the west. Beyond this ridge and due south of our turning-point the land rose to high snowy mountains, corresponding with the high mass seen by Ellsworth and shown in Joerg's Map C (*Geographical Review*, July 1937). The high land seemed to extend west, and may have been what Wilkins saw in 1929 from Charcot Island, rather than the continent itself.

The south-west limits of Alexander I Land remain uncertain, for on Ellsworth's photographs from 13,000 feet it is impossible to distinguish between land, shelf, and sea-ice.

DISCUSSION

Before the paper the CHAIRMAN (Mr. LEONARD BROOKS) said: I am exceedingly sorry that the President cannot be in the Chair. He was at the Council Meeting this afternoon, but important duties have taken him away again.

The paper to be read is on "Graham Land and the problem of Stefansson Strait." Our lecturer, Mr. Alfred Stephenson, has been aptly described as a veteran of the younger generation of Polar explorers. He was a surveyor on Mr. Watkins' British Arctic Air Route Expedition to Greenland in 1930–31, and was then for a year at Fort Rae, one of the stations occupied as part of the British programme in the Second International Polar Year of 1932–33. Then Mr. Rymill selected him in 1934 to be the senior surveyor on the British Graham Land Expedition, and he was down south with Rymill for about three years.

Since the time, two years ago, that Mr. Stephenson and Mr. Fleming gave their joint paper on the exploration of King George Sixth Sound, the greatest discovery of the Graham Land Expedition, Mr. Stephenson has been steadily at work compiling the final map of the area and trying to relate it to the flights of Wilkins and Lincoln Ellsworth. In his paper he will sum up the survey results of the British Graham Land Expedition, produce the final map, and discuss the problem of the elusive Stefansson Strait. I have heard this described as the great Antarctic detective mystery, so that if you would be in at the death you must pay close attention to the clues as Mr. Stephenson lets them loose upon us.

Mr. Stephenson then read the paper printed above, and a discussion followed.

The CHAIRMAN: Having heard the Antarctic mystery elucidated, there are several present who can contribute to its discussion. I call first upon Dr. Bertram.

Dr. G. C. L. BERTRAM: It has given me much pleasure to hear Mr. Stephenson; he has brought back many happy memories to me and has reminded me what a good teacher he is. When we were in Graham Land he did much to enlighten biologists like myself on maps and survey.

Soon after we returned from the expedition in 1937, we met Sir Hubert Wilkins in the House of this Society. We told him we were thinking that some of his conclusions were not quite sound. He seemed more interested then in how to build a submarine. I think that the detectives, Mr. Stephenson and Mr. Hinks, have solved their problem, and we now look forward to hearing what Admiral Byrd has to say when he has photographed and travelled over some of the same country. We have not so far received much information from his party in the Graham Land region; in fact there is strangely little news of the whole expedition in that very stormy area. We wait with interest to hear. If his geologists are able to get into Alexander I Land they may find something of extraordinary interest.

In conclusion, you may be interested to know that the last of the dogs which took us down King George Sixth Sound died about a month ago. It was brought home by Quintin Riley, but it has now had to be destroyed.

The Rev. W. L. S. FLEMING: Mr. Stephenson has very convincingly disposed of Stefansson Strait, and evidently with great personal satisfaction: I can regard it only as a calamity. If the Antarctic continuation of the Andean Mountain chain in Graham Land had ended southwards in a few small islands, set abruptly against a mainland coast running athwart the trend of the mountain arc, it would have been of great geological interest. When we went south, I was eagerly looking forward to studying these peculiar features; but it was not to be. However there have been many compensations. In the first place, King George the Sixth Sound is a fault feature of remarkable character, 250–300 miles long, with Mesozoic sedimentary formations on its western side. Professor Alton Wade, who was geologist of Admiral Byrd's last Antarctic expedition and is the chief scientist of his present expedition, has found evidence to suggest that the rocks of the Edsel Ford Mountains have affinities with the formations found in Graham Land. It is to be hoped that he may find further indications of the extent of the Antarctic Andes south of the point where we left them, and discover the geological relationship of this mountain system to the faulted structures round the Ross Sea.

The CHAIRMAN: It is almost impossible to hold a meeting of the Society to discuss polar exploration, either Antarctic or Arctic, without asking Mr. Wordie to speak.

Mr. J. M. WORDIE: I have always had a great interest in the part of Graham Land which has been described this afternoon by Mr. Stephenson, for it has been a problem of which geologists in particular have been aware—how this peninsular part of the Antarctic joins on to the main continent proper. The recent uncertainty started, of course, with the invention of the aeroplane and the obvious desire of some fliers to fly in the Antarctic before it was perhaps quite time to do so. They had a new weapon and tried to make use of it before its uses and limitations in geographical discovery were fully understood. Sir Hubert Wilkins made a remarkable flight, and as a consequence stampeded us, and we found ourselves accepting Graham Land as an island. That Crane Channel was not a channel but a glacier is shown by Wilkins' own photographs; but we hesitated to abandon Casey Channel and Stefansson Strait, although both should obviously have been questioned once Crane Channel was in doubt. Mr. Lincoln Ellsworth had, I understand, more modern equipment than Wilkins, and it has apparently been easier to keep track of his discoveries, although here also there have been complications partly owing to the fact that Ellsworth was naturally anxious to accept Wilkins' results as definite. The result has been three years' hard work for Mr. Stephenson; but he has been fortunate in having the support of Mr. Hinks. In conclusion, may I thank Mr.

Stephenson for giving us such a closely reasoned and admirable lecture, and congratulate him on bringing his work to such a successful conclusion and producing a solution which we hope will be final.

The CHAIRMAN: In all the detective stories I have read there is always someone who sends out the detective and is usually called the Assistant Commissioner. I think we should have a word from the Assistant Commissioner, Mr. Hinks.

Mr. A. R. HINKS: I have, as Mr. Stephenson has told you, had a certain amount to do with this matter from time to time, and I know full well what a triumph Mr. Stephenson achieved when he did at last identify two regions photographed and fixed by Rymill with two regions photographed by Ellsworth: one lot from nearly the reverse side, and the other with rather insignificant features easily overlooked. But he did get two perfectly certain identifications. And then all the trouble has been in trying to interpret Wilkins and Ellsworth in the light of those fixes.

I have tried time and again to come to any other conclusion than that Ellsworth when he flew down on 21 November 1935 quite certainly took for Stefansson Strait what Wilkins called Lurabee Channel and Joerg Lurabee Glacier. The pictures Ellsworth took, and his description in the log, perfectly explain why, in response to inquiry by wireless from the *Penola*, he said that Stefansson Strait was certainly there but "it is only about 3 miles wide." I feel sure he was thinking then in terms of Lurabee Channel, which he mistook for Stefansson Strait as he flew down. On the way back he didn't mention Lurabee Channel, but flew right past it, seeking that mysterious feature Cape Eielson. Concluding they were actually east of the Strait, and must have been drifting north, they turned sharply west at about 13.50, passed what Kenyon logged as Cape Eielson at 14.10, and took all the photographs labelled Stefansson Strait in 1936. It is possible to make the most beautiful identifications with the photographs taken two days later. But there is a great deal of trouble about the times because if they turned at 13.50 and flew at 100 miles an hour, by 14.50, when they began circling over what they thought was the Strait, they ought to have been over Marguerite Bay on the west coast of Graham Land. It is impossible to reconcile the times allotted by Ellsworth to the photographs upon that 21st flight.

But it is quite clear that there are three names always turning up which are not yet exactly placed: Cape Eielson, Stefansson Strait, and Cape Keeler. Cape Eielson exists only in that very unsatisfactory photograph by Wilkins in which it is said only to be visible among the nunataks; nobody has yet seen it except Wilkins. Cape Keeler is the object named by Wilkins which Joerg says Ellsworth and Kenyon mistook for Cape Eielson on the 21st. That is too facile an explanation; it makes far more difficulty than it explains.

Meanwhile it is certain there were two Stefansson Straits: the one that Ellsworth saw on his way down, Lurabee Channel, and the one which he saw on his way back and flew around in, and identified again two days afterwards, and which is, I think, undoubtedly what Wilkins called Casey Channel. I think Joerg is wrong in moving the name Casey some way to the south. But what it was that Kenyon mistook for the elusive Cape Eielson if it was not Cape Mayo, I cannot at all guess. However we must not make too much of this detective story.

There is an interesting part of the inquiry, which has not led to much result, and to which Mr. Stephenson has not referred: Where are Ellsworth's Eternity Mountains with the three peaks in a row he named Faith, Hope, and Charity? The Eternity Mountains, in repeated references to them, turn up all over the

area examined by Rymill and go right into Alexander I Land. One had hoped that the three in a row, Faith, Hope, and Charity, might be identified, because Rymill had three mountains in a row, the middle one of which he called Mount Wakefield. We played for a little with the idea that these might be Ellsworth's mountains; but unfortunately there is no photograph taken by him to which he has affixed the name of either Faith, Hope, or Charity. And since it is Rymill's middle peak that is named after a very generous benefactor to the expedition, one could not identify it with Hope rather than with Charity. So the correct placing of these names given by Mr. Ellsworth has to be left for the future. Meanwhile I would like to join with you in congratulating Mr. Stephenson upon the great success that this laborious investigation has reached and, in particular, upon his brilliant exposition of a very tangled subject.

The CHAIRMAN: It remains for me to echo what Mr. Hinks has just said and congratulate Mr. Stephenson on a remarkable piece of geographical work. We have spoken lightheartedly perhaps of it as a detective story, but of course it is a much more serious business. I knew we should get a very clear exposition from Mr. Stephenson. We all join in thanking him for having taken our minds completely off affairs outside for an hour and a half.

DIAGRAM RELATING THE DISCOVERIES OF WILKINS AND ELLSWORTH TO THOSE OF THE BRITISH GRAHAM LAND EXPEDITION *on back of folding map*

On this sheet we have brought together various representations of Wilkins' and Ellsworth's flights in their relation to the surveys of the B.G.L.E. Wilkins' sketch-map of his flight of 20 December 1928, published in *Geographical Review*, July 1929, is shown in light brown; the lettered arrows represent his placing of his photographs L to R, for which no times are given.

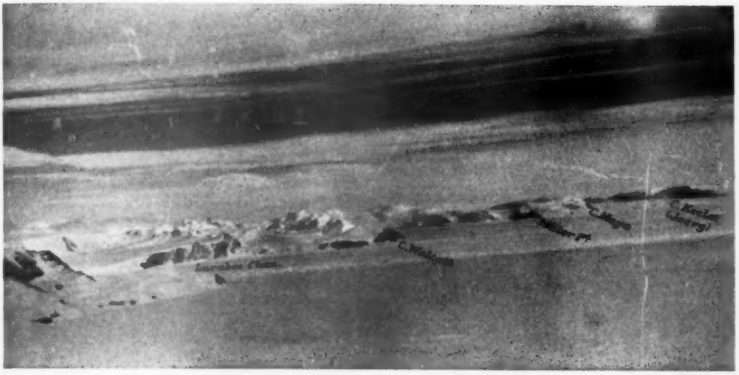
The preliminary interpretation of Ellsworth's flights published by Mr. J. W. L. Joerg in *Geographical Review*, July 1936, is shown in light blue, his second representation (*Geographical Review*, July 1937), influenced by the discoveries of the B.G.L.E., is shown in dark blue. Ellsworth's photographs of the flight of November 21 are lettered A.1, A.2, etc.; those of the flight of November 23 are numbered 1, 2, etc. The time scale along the second flight is that of Joerg's maps A and B (*Geographical Review*, July 1937), to which we do not suggest any material modification. Joerg has given no time scale for the flight of November 21, and we equally have found it impossible to make even a suggestion of one; the times assigned to the photographs cannot be reconciled with their relation to one another or to those of other series. To show how well the flights of November 21 and 23 are related by the photographs, we have drawn lines from Joerg's plumb points of photographs to principal common features. Most of the identifications are positive and one can find little to criticize in Joerg's reconstruction, though parts are not so strong as others. He remarks himself that the connection north and south of what he has called Cape Walcott is weak, but there can be little doubt that it is substantially good. Our identification of Ellsworth's A.5, A.10, and A.11 with Rymill's R.40 places the whole area of Map A north of Rymill's traverse to the east coast and near the position assigned by Joerg to it on his Map D.

Joerg, on Map A, has assigned Wilkins' names to the features he has drawn from Ellsworth's photographs. The positive identification of Lurabee Channel of Wilkins with Lurabee Glacier of Joerg ties down the names Lurabee, Scripps, Finley, and Walcott to Map A. We shall, in what follows, find reason to think

that the name Casey belongs to the Major Valley Depression and not to the glacier to which Joerg has assigned it, and to consider in what way the names Keeler and Ranck belong to the very indefinite neighbourhood in which Joerg has placed them. There is no difficulty in accepting the position Joerg has assigned to Wilkins' photographs L, O, and N; P and Q are not quite so certain; Wilkins' M he has left unplaced.

Accepting then the position assigned to Map A by the tie which A.5, A.10, and A.11 provide, we may interpret Ellsworth's flight of November 21 thus: They were at sea when Hollick-Kenyon logged "Mount Ranck on the right" at 11.25, and passed the message to Ellsworth "Stefansson Strait and Scripps' Island forward and right." They were still at sea when at 11.50 Ellsworth logged "Stefansson Strait (over)." Photographs A.1–A.4 are assigned to 11.50, as taken to starboard. These four cover the coast from Cape Mayo to Finley Peninsula on Joerg's Map A. From Ellsworth's 'Beyond horizons,' p. 312, at 11.35 he "stared across the entrance of Stefansson Strait . . . much narrower than Wilkins had suspected . . . not over a mile or two wide in places." At 11.35 he was looking up Lurabee Glacier, nearly ahead. The words "stared across the entrance" fit this, and whatever we make of the note "over Stefansson Strait" at 11.50, it seems evident that the strait only a mile or two wide which he reported upon to Rymill as Stefansson Strait must be Lurabee Channel. The log has no mention of Cape Eielson, which should have been seen to port, and for which they were presumably looking as a landmark, since it was later much in their minds. At 12.00 Ellsworth logged "entered Hearst Land, picture 5 from starboard side at right angles"; but the distance of A.5 from the group A.1–A.4 makes it necessary to assign to the photograph a time about 12.11. At 12.12 Kenyon logs "still getting up pass," or climbing to Rymill's lower plateau. At 12.16 there were high mountains right and left. From 12.19 to 12.22 the group A.6–A.9 was taken, identified with Rymill's RD.85, and A.7 is titled (Joerg, 1936, Fig. 8) "looking S.E. over main axis Eternity Range." At 12.24 Kenyon radioed "9000 feet and still hills on right above me" which may have been Rymill's Mount Wakefield range. At 13.00 Kenyon found conditions too bad and turned back. In 'Beyond Horizons' Ellsworth says that with a howling gale at their back they came back to the Weddell Sea in thirty minutes. At 13.37 Kenyon radioed "open sea on right" with again no mention of Cape Eielson where it must have been expected. The group A.10–A.13 is logged as 13.41–44, the first two tying up with A.5 on Rymill's R.40 and A.13 to the same, thus also fixing, perhaps a little doubtfully, Wilkins' P. At 13.45 Kenyon radioed "nearing coast about 40 miles east of Strait, must have drifted north." At 13.50 Kenyon changed course 18° westwards, a little north of A.13.

So far there is not much difficulty, but at this point the interpretation becomes very obscure. At 14.00 Kenyon radioed "over Cape Eielson, at least I hope it is." At the same time Ellsworth took A.14 and A.15 to port. At 14.12 Kenyon logged "Cape Eielson," and at 14.14 radioed "passed Cape Eielson now, last report (14.00) false." Ellsworth in 'Beyond Horizons,' p. 315, says that they *rounded* Cape Eielson at that time. They then flew westward, and from this time no courses or speeds were logged. Photograph A.18 was logged by Ellsworth as taken to port at 14.30 and A.19 to starboard at 14.52; but they overlap, and were evidently taken close together. They show in the foreground detail which appears in the middle distance just under the wing in photographs 7 and 8 of the 23rd, and were therefore taken south-east of the latter, as plotted by Joerg. They compelled him to plot the swerve to the south which fits so badly with the references to Cape Eielson (or Keeler, as Joerg would have it) and with Kenyon's radio "over Strait now" at 14.17 and "over Stefansson Strait" at 14.30. At 14.52



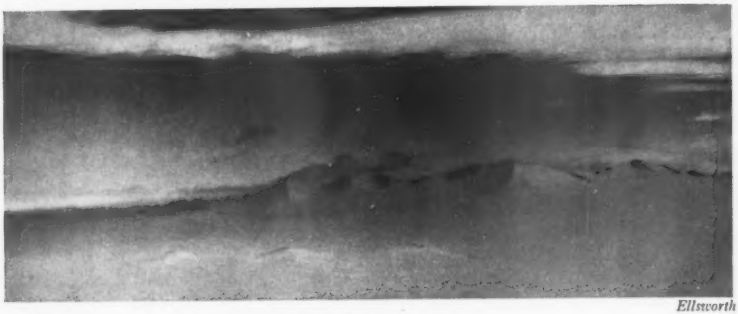
EA.2 *November 21 11.50* *Ellsworth*

E.2 *November 23 12.21* *Ellsworth*

E.8 *November 23 12.40* *Ellsworth*

Bingham

RD.40 *322° true from 69° 45′ S. 63° 31′ W.*

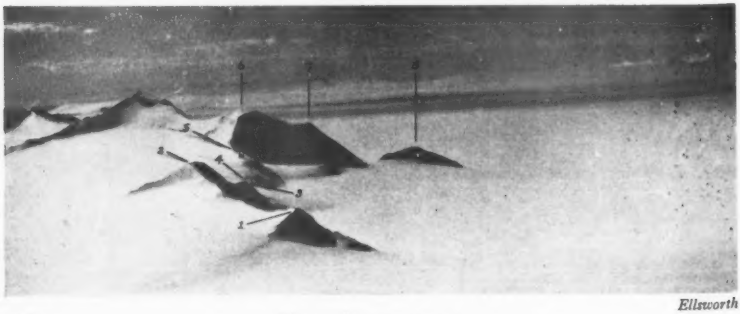


Ellsworth

EA.5 *November 21 12.11*

Bingham

RD.85 *01° true from 70° 10′ S. 63° 54′ W.*



Ellsworth

EA.9 *November 21 12.22*

he radioed "won't go through Strait, it is full of clouds to Bowman, trying to see if channel or glacier" and at 15.00 "sides are crevassed like glacier but middle in . . . looks a channel O.K. well enuf; am turning back to Weddell Sea and then north along coast." One may write into these fragments they had gone some way up a channel or a glacier and come out again searching backwards and forwards. An hour's direct flying on the course plotted by Joerg would have taken them right across to the west coast and out over Marguerite Bay; Joerg's track is probably over simplified. In any case the Stefansson Strait of this homeward part of the narrative for November 21 cannot be the same as the Stefansson Strait of the outward flight.

On the flight of November 23 the course was parallel to that of November 21, but some 30 miles west of it according to Joerg's map A. Photographs 1, 3, 5, 6, 7, 9, 10, 11, and 12 to starboard, and 2, 4, 7, 8 to port, all show detail which can be connected with detail of later photographs of the 21st: a sight of these connections, as shown on our diagram, can leave no doubt that Joerg's plot of November 23 is substantially correct. At 11.23 on November 23 Kenyon had radioed "Cape Eielson and the straits ahead, bit too far east," and Ellsworth had logged "Cape Eielson dead ahead." They changed course to bring them west of the cape. At 11.50 Kenyon radioed "I think we are too far east to see Northrop clearly," and at 11.54, while still a long way out at sea, "very confusing mass of islands in front, I think must have been in Lurabee Channel last note," which is incomprehensible. At 12.15 Kenyon radioed "channel is one I was in last time and is Stefansson Strait, not Lurabee." At 12.17 Kenyon logged "Cape Eielson close left" and at 12.25 "long straight channel is coast, and is one I was in last time": that is to say, the Stefansson Strait of their homeward journey on November 21, which we shall find is Casey Channel.

The problem now is to locate Cape Eielson, described by Wilkins as a low cape, surrounded by nunataks; his only photograph (*Geographical Review*, 1929, p. 369, Fig. 34) shows the nunataks but no cape. If it had been conspicuous where Wilkins placed it Ellsworth should have seen it to port on his way south on November 21, but the name is not mentioned until they begin to identify one mass after another for Cape Eielson a great deal further north; and what was presumably the same mass was close left at 12.17 on the 23rd. Ellsworth insists that Cape Eielson, in his recollection, is identified by the surrounding nunataks as photographed by Wilkins; on the other hand in a letter to the editor of 24 July 1938 Mr. Hollick-Kenyon said that identification was positive, that long deeply cut fjords into a land 5000 and 6000 feet high seemed to correspond to the description of Cape Eielson, that the Cape is a blunted promontory with fjords to the west and north, that land exists to the north, that on both flights they rounded Cape Eielson before they expected, and were positive from Wilkins' map that it was Cape Eielson.

Unfortunately they did not on either flight make any photograph of this celebrated feature, or what they took for it; and a main theme of Joerg's 1937 solution is that what they called Cape Eielson was really Cape Keeler, the name given by Wilkins to the south-eastern promontory of the Bowman Coast north of the entrance to Casey Channel. South of this entrance is Cape Mayo, the eastern promontory of Scripps Island. On Wilkins' map (*Geographical Review*, 1929, facing p. 374) Cape Keeler, Cape Mayo, Miller Point, and Cape Walcott are in a line and about equally spaced. Ellsworth's photograph A.2 looks up a straight coast on which the last three names are placed with good probability. Rather far beyond Cape Mayo is a dark promontory to which Joerg assigned the name Cape Keeler, with Wilkins' Mount Ranck nearby. He makes nothing of the difficulty that Wilkins' Cape Eielson faces north or north-west and his Cape

Keeler south-east. We may agree that his Cape Keeler on A.2 is in about the place where Ellsworth and Kenyon saw their Cape Eielson ahead at 11.23 on November 23 and altered course to the west; but we think it may be left as Wilkins placed it, north of the entrance to Casey Channel. Wilkins' photograph M shows Cape Mayo, Casey Channel, Mount Ranck, and Cape Keeler rather close up and bunched together. Joerg has not placed that picture. We suggest it was taken about 8 miles S.S.E. of his L on map A, or at any rate at a point too close under Ellsworth's machine flying at 13,000 feet on November 23 to be included in his No. 2, which shows Miller Point and something at the lower edge that may be the tip of Cape Mayo. At 12.17 on November 23 "C. Eielson" was close left, and the times on this flight are consistent, at least here. Whether what they had logged as Cape Eielson on November 21 at 14.00 or at 14.12 was the same is doubtful. But we suggest that the channel in which they cruised on that afternoon has its eastern entrance between Cape Keeler and Cape Mayo as Casey Channel should; that the Major Valley Depression is its continuation; that the difficulty about A.18 and A.19 can be explained by an unlogged loop in their flight; and that Joerg's diagram at the top of p. 455 (*Geographical Review*, July 1936), is a better representation of the course, though not the location, than his map A of 1937.

There are difficulties about this or any solution, mainly owing to the impossible time-record of November 21 and the absence of any logged course after 13.50. But it has some advantages. It provides from Wilkins' M features agreeing well with Kenyon's account in the letter quoted above; and it leaves Wilkins' names in relation to the land as he placed them except for Cape Eielson and Stefansson Strait, which have disappeared from the picture.

In a letter of 12 June 1938 to the Editor, Sir Hubert Wilkins concurred in the reorientation of his photographs, made by Mr. Joerg on map A: P from about 276° to 203° and Q from 258° to 206°. They now face the coast running north-west from Rymill's cape in 69° 40′ S., the coast shown in a pecked line as conjectural, out of sight from Rymill's most northerly station. The Stefansson Strait in the title of P (*Geographical Review*, July 1929, Fig. 32) is then no more than the Weddell Sea: the Finley Islands the "rock outcrops not indicated" in the south-east corner of map A, well south of Joerg's Finley Peninsula. If P and Q may be swung round about 60° anything may happen to R and Cape Eielson. As for Ellsworth's Eternity Mountains, there is no photograph of the three summits, Faith, Hope, and Charity by which they may be recognized on the B.G.L.E. surveys, and the name Eternity is spread wide; what is called the Third Range of these mountains must be in Alexander I Land. It does not seem convenient to give so great an extent to a single name. But the discussion has enabled us to accept for the greater part the brilliant interpretation of Ellsworth's photographs made by Mr. Joerg and his colleagues of the American Geographical Society in 1937, and to place it firmly on the map by relating it to the surveys of the B.G.L.E. to the south of it.

We gratefully acknowledge the courtesy of the American Geographical Society in placing at our disposal original documents, marked photographs, and other material used in the construction of Mr. Joerg's maps of 1937; and we have to thank in particular its Secretary, Mr. John K. Wright, who not only sent us what we had asked, but thoughtfully included more. Sir Hubert Wilkins, Mr. Lincoln Ellsworth, and Mr. Hollick-Kenyon have been unfailingly kind in answering inquiries on special points: and their united endorsement of Mr. Joerg's 1937 solution has greatly simplified our task. A. S.

See also the Additional Note on p. 229. A. R. H.

THE BAY ISLANDS, GULF OF HONDURAS

R. W. FEACHEM

DURING the summer of 1939 I paid a visit to the Bay Islands, being joined by Mr. Derek Leaf for most of the time. Both local and European reasons cut the expedition short, but in the time available we were able to accomplish much, owing to aid from many quarters. The support of Lord Moyne, of the Royal Geographical Society, the University of Cambridge, the Faculty of Archaeology at Cambridge, and Trinity College, made the expedition possible, and their generosity was perfectly appreciated; while in the Gulf of Honduras, the interest of H.E. the Governor of British Honduras, the active assistance of Mr. Masson and Captain George Gough at Belize, and the continued help and guidance given to us by Captajn Joe Gough and Mr. Frank Boynton in the Islands, assured the best possible conditions for the work.

Under the circumstances in which this is written, it is impossible to get at the various works which the problems arising from the Bay Islands need for their elucidation; and on certain points, such as distances, the memory is apt to fall short. To avoid inaccuracies therefore, only points on which there is certainty will be written as facts, the rest being qualified.

The Gulf of Honduras is bounded to the south by the north coast of the Republic of Honduras, on the west by the coast of British Honduras, and in the angle by the coast of the Republic of Guatemala. The Bay Islands run in a chain north of the Honduras coast; the south-west end of the chain is some 25 miles from the coast, and the north-east end about 40 miles from it. Almost centrally placed between the middle of the chain and the coast of Honduras is a group of two islands and thirteen cays, known as the Hog Islands, Cayos Cochinos. The main chain, Islas de la Bahia, consists of six islands: the most westerly is Utila; after a gap of a little under 20 miles comes Roatan. Immediately east of Roatan is Helene, then come Morat and Barberat, and, after another long gap, Bonacca.

Utila, the western island, is about 6 miles long, having a hill some 250 feet high at the east end, from which a plain and mangrove swamps extend to the western boundary. This plain is very fertile where it is not under mangroves, being productive of fine bananas, pineapples, and coconuts. The chief settlement, Utila town, is on the southern side, and contains indications of previous original culture: a well, known as "Indian well", is said to have been a relic of the earlier occupants, and a stone causeway leading to it is said to be of the same age; restoration has removed the character from this well recently. Escorted and guided by some of the Utilans, we visited the place on the north shore where Junius Bird, nearly ten years ago, found a number of urn burials; an account of these was amalgamated with his own material from other parts of the Islands by Duncan Strong in a Report published by the Smithsonian Institute. On arrival at the place, an urn was very soon located by William Waterhouse, who had helped Bird; and, on being unearthed, was found to contain coral sand and about half the bones of a skeleton, including a skull.

The urn was covered by a monochrome pottery tripod vessel, with incised ornament, inverted over the rim; the urn itself was about 2 feet high, round-bottomed, with no ornament whatsoever, and made of a strong dark clay, with simple turned lip. The skull is now in Cambridge, but the olla, exactly similar to those described by Strong, never got farther than the Commandante's office in Roatan. Other features on Utila are a number of long low artificial mounds along the northern shore, and the great labyrinth of caves which honeycomb the hill. Of these are told many and curious stories, concerning great treasures of Spanish and earlier times which are reported to have been discovered in them from time to time. Leaf, with Waterhouse and another guide, Eddie Whitefield, and some other Utilans, penetrated over 65 fathoms into one of these caves, but found nothing except bats and their faeces, the latter in prodigious quantities. It was reported that from time to time persons had attempted to export this guano, but never were able to establish a flourishing trade; if any treasure is to come from these caves it will surely be this. A number of seasons could well be spent investigating the past of Utila.

Roatan, east from Utila, is some 30 miles long, with a chain of hills up to 800 feet along the spine, being at the broadest 9 miles wide. Strong was able to make an examination of some of the central sites, and for local reasons we decided, in agreement with Gough and Boynton, to work east from Roatan to begin with. The island has a few scattered Carib settlements on the north shore, notably Punta Gorda and Pollatilla Bight: a visit to the former with Gough quickly demonstrated the pleasant and easy characters of the Caribs, who have much Negro blood in them, while their village, with its thatched huts and cows and pigs, was like Wiltshire with palm trees. On the south shore the administrative centre, Coxon Hole, once Port M'Donald, is situated some 9 miles from the west end. East of it come French Harbour, which has the distinction of having a British Commandante, Jonesville, and Oak Ridge. Oak Ridge is the main trade centre of the island, and was our base. East of Oak Ridge is Port Royal, a large and well-protected harbour, now almost uninhabited, on an island in which stands the remaining part of what was once a great stronghold of British and other pirates; lead can still be picked from the walls, a testimony of the last great battle which led to the final extermination of the nest. The east end of the island is made up of the end of the hills and a mangrove swamp about 3 miles long. On the north side, at the point where the good land gives way to the swamp, is a headland known as Pulpit. Near this we examined a very extensive ancient settlement site, which has unfortunately been rifled. But near the shore there is a great rock, some 24 feet by 17 feet, which bears on its surface forty-four holes, averaging 4 inches deep by 6 inches diameter. It is possible that these are erosions due to natural causes, the stone being conglomerate; but their position, and the fact that they stop far short of the limit of the surface, lends weight to the assumption that they might be artifacts. The immediate proximity of the large settlement, itself surrounded by extensive fertile land, suggests a ceremonial centre. And to the stone mentioned another can be added, the two being the only ones observed on the island. This second one, also conglomerate, is in Fiddlers Bight, a mile east of Oak Ridge, and measures 12×12 feet; on its surface are about two dozen similar indentations. The

Pulpit stone was not known before, and was not discovered this time until Boynton sat upon it to rest. The carving of horizontally placed stones was not unknown on the islands, as will be seen in the account of Bonacca, and until an expert geological opinion can be had, it is safe to assume the possibility of the artificial nature of these holes.

Helene stands immediately east from Roatan; a mangrove swamp comes out to connect with the Roatan western swamp. Between the two is a creek, never more than 50 feet wide and sometimes as little as 20 feet, through which strong tides run. We went through it two or three times in a 35-foot motor boat without any difficulty except that the mangroves tended to come aboard at the sharp bends, and the sand bar at the south end was insufficiently covered at anything but high water. The Helene swamp gives way, after from ½ to 1 mile, to rugged and precipitous limestone cliffs. 1939 was a particularly dry season, as many withered crops up and down the islands bore melancholy testimony, and the change in general since Mr. Mitchel Hedges and his secretary visited the place some years ago is remarkable. Then, according to 'Blue blaze,' the mangrove trees were 200 feet high, whereas in 1939 they were a mere 30 feet. Picking our way easily, Thomson from Oak Ridge and myself reached the cliffs, and examined two or three of the caves which are situated in their face. Judging by the small mounds of debris slowly sinking into the swamp outside the entrances, the caves were once inhabited and once excavated; nothing now remains but the bats and their dung. East of these cliffs the land is hilly, with peaks of about 300 feet, until the east end, some 5 miles away. The last three hills, known collectively as Indian Hill Helene, have had prolific sites upon them; the westerly one was tried without success, having been completely dug away. The central one, from which many of the finest specimens in Lord Moyne's collection came, is also exhausted; it is situated in a corrie facing south, and beneath it lie fertile slopes which could easily support a large population. A few beads and painted sherds from this site added evidence to the specimens at hand of the undoubted connections which the culture in occupation had with the Ulua valley. Another site was found untouched, and must have been very similar to the Helene one; but a preponderance of Ulua-type painted tripod cylindrical urns at Helene was very noticeable in the debris. On Helene a barber's pole snake was seen: one of our Carib assistants slashed at it with his machete, but failed to reach the deadly creature by a very safe margin, remarking in justification that his knife was too short.

Morat lies about a mile east of Helene; it is a small island, not more than a mile long and less in width. There is a western and a southern bay, both of which are good anchorages; the land slopes through a fertile plain from the south to a hill at the north, from which steep cliffs fall to the sea. On this hill are extensive signs of earlier population, again topping good cultivating ground. The beach on the east side of Morat contains among the shingle many coloured stones of the type used by the early Bay Islanders for making beads, as well as outcrops of greenstone and green soapstone from which amulets were made. Two sites were examined on Indian Hill: the first contained many sherds, but had been disturbed before. The second site was untouched, lying under grass. The earth was hard like baked clay, and only

laborious toil made any headway, but shortly after we started, a Carib turned out a small marble tripod mortar, 6 inches high, which was inverted in the ground. This put courage and hope into the company, and subsequent results were very satisfactory. Included were a few of the implements peculiar, as far as can be discovered, to the Bay Islands: large rough-made stone heads, aptly named "Ace of Spades," also many sherds, a few whole pieces, and an abundance of marble work, mostly fragmentary. On Morat, as on Helene, the willing cooperation of plantation workers was invaluable: in both cases the men were Caribs from the Cayman Islands; the Helene pair were two brothers, Tom and Herbert Forbes, whose gifts of all kinds of bananas, plantains, and cocos or potatoes were astonishing in their abundance and acceptable for a menu consisting chiefly of fish. On Morat the men had also helped Lord Moyne: a father and his sons, Cleveland, Telford, and Butterfly Bodden.

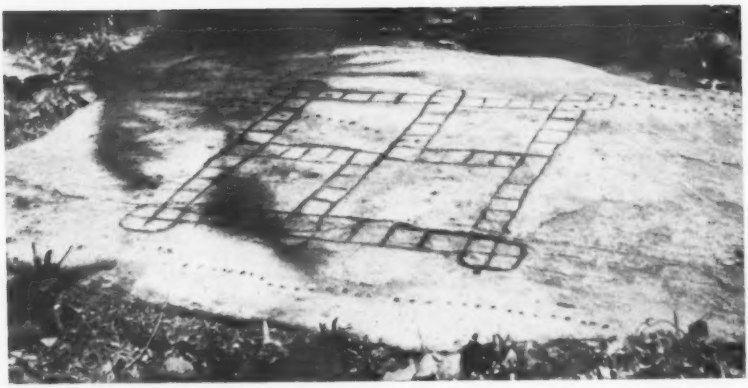
Barberat, about a mile east of Morat, has a peculiar charm which makes it by far the most pleasant of the Bay Island chain: 3 miles long, with a backbone of hills and a skirt of coconut palms, it is the nearest thing to the Tropic Isle imaginable. The two plantation men, Wesley and Brindley Cooper, were invaluable in the work done on Barberat. The central hill, Indian Hill, is reached by walking up a shady glade known as Pear Tree Gully, from the great avocado pear trees which grow in it; unfortunately the thieving green parrots, which inhabit the gully, make the air hideous with loud cries and the ground rotten with the pears they bite off. On the hill top is a very extensive site: almost a mile continuously shows signs of ancient inhabitations. So prolific was this site however that it had attracted both visitors and natives, and it was soon established that only one small part, centrally placed, had been left untouched. The cotton tree grows with large bastion roots on the surface, as well as a sturdy complement beneath; it is a large and tall tree, and spreads its branches high above the cohune palms and other units of the bush. It was under the protection of a particularly fine cotton tree that this last remaining island had been left. The Coopers, the Boddens, Thomson, and myself set to work, and after many days had left only a small cylinder of ground untouched, immediately beneath the trunk of the tree. The machete of Butterfly Bodden and the hoe of Brindley Cooper made a path for the trowel and the knife, and from this hole much stratification and order was obtained, as well as many specimens, not a few of which have, as far as can be known, no previous parallels from the Bay Islands. Among these may be mentioned a stone ring, incomplete, carved in the form of a conventional beast, which may have been used for holding round-bottomed pots; and a very curious pottery vessel, in the form of an egg, without any opening except a very small hole in the bottom, round which are arranged six small legs. This vessel stands some 8 inches high, and is of the coarsest pottery. Also found were some red and purple pigments in block form: these, with the curious vessel mentioned above, indicate that the particular part of the site left for us to investigate may have been a pottery, and the curious vessel some sort of mould for vessels to be built up on: all pottery shows signs of having been built up on the coiled strip system, for which a mould might be very convenient. Also from this site came an obsidian spear-head and a painted vessel. This tripod, painted

Bunkers Nose, Hog Islands

Pelican Point Pier on Barberat Island

Little Hog Island, Booby Cay and mainland beyond

Standing stones at Bonacca enclosure

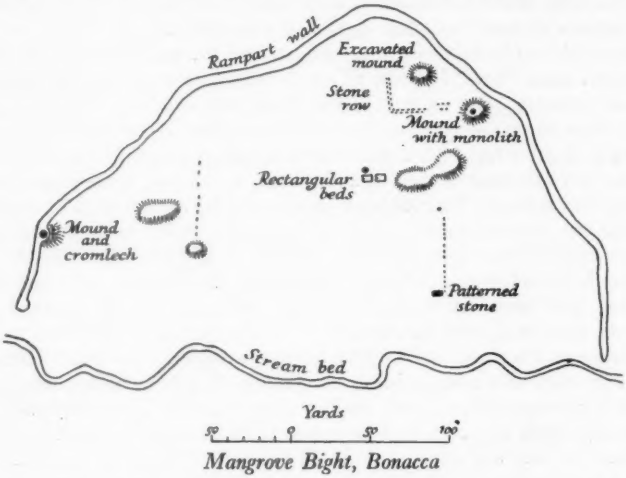


The Bonacca stone

Old capstan at the slipway in Utilla harbour

all over outside and on its legs, was of a delicate wasted form, and had been broken in antiquity, not all the pieces being placed in the earth: the pieces that had been preserved, over two-thirds of the vessel, had been wrapped round a monochrome vessel with a large body and disproportionally small neck. No other sites were located on Barberat.

Bonacca has little in common with the rest of the Bay Islands: it stands north-east from Barberat across a strait some 20 miles wide. The chief settlements are Bonacca town and Savannah Bight. Bonacca is built on some small cays and made land, away from the rather unhealthy shore, and is a very delightful town, gaily painted and appearing to be floating on the water from even a short distance. On the north-west coast, directly opposite Savannah Bight on the south-east, is Mangrove Bight. North-east of these bays is the last lobe of the island, on one of the hills of which is a large site known as



Mangrove Bight, Bonacca

Marble Hill, which we had no opportunity to visit. On the neck of land between the bays is situated the most striking site to be found on any of the islands. One hundred years ago it was visited by a lieutenant of the Royal Navy, who mentioned in his report a large walled enclosure, and also that he saw in this enclosure three stools on which sat greenstone idols. At Bonacca we had met Mr. Colin Pinckney, from the Department of Anthropology at Cambridge; he and Leaf made a survey of the walls of the enclosure under very difficult conditions, subsequently being able to place the complices located inside in their correct position. The map is copied from the one made by Leaf, and shows the chief points of interest in the enclosure.

The rampart wall is similar in general appearance to the Saxon walls in England. Within it were the following features: on the west side of the wall is an inward excrescence, on which stands a small cromlech; the three supporters are undressed stones, reaching to about 9 inches above the present ground-level, on top of which rests a flat stone roughly 3 feet in diameter.

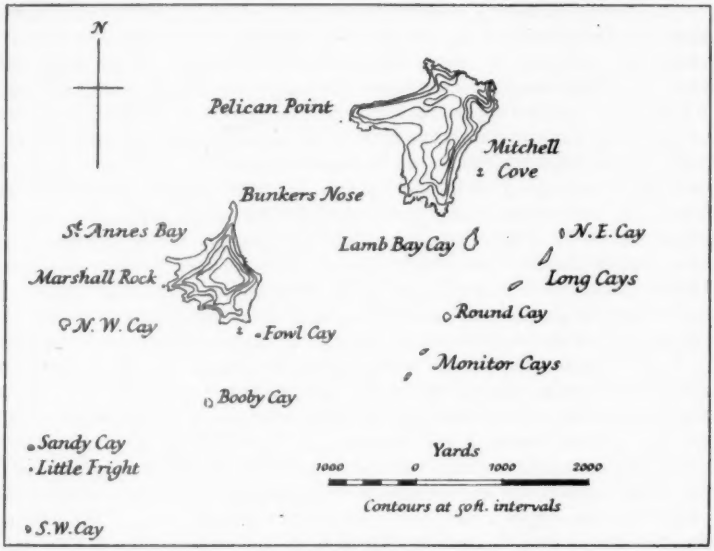
This may well be one of the three stools observed by the lieutenant, but if so, the idols are gone. No other such stools were located. Towards the northern limit is a large mound, standing some 15 feet above the general undulating ground-level, in which was observed a trench believed to be that dug by Mitchell Hedges. This was continued through the top of the mound, revealing its structure—originally a smaller mound of hard dark earth had been built on ground-level; this had a covering of large, generally flat stones, above which came some 3 feet of light soil, in which was found a greenstone amulet, bearing a whiskered face. A few yards south-east of this mound is another, smaller, on which stands a 6-foot monolith. On a line west from this mound, running to a point south-west of the first mound, and then to a point west of it, is a double row of standing stones, from mere stumps to 9 feet in height, of which sixty-nine could be counted. South from this mound and stone complex is a large rambling mound, possibly natural, at the west side of which lie two systems of small flat standing stones, averaging about 1 foot in height; these are laid out in the forms of rectangles, with the west ends doubly bowed outwards. Each "bed" is some 15 yards long, and both run on the same east-to-west axis. Near the west end of the western one lies a large flat stone. South from the possibly natural mound runs a line of flat standing stones, generally about 2 feet high and broad; after about 50 yards they terminate, and immediately west of them is a flat stone, 14×8 feet, lying prone on the ground. On this was observed what appeared to be a number of squares; on clearing the coconut trash and other vegetable residue from the stone, it immediately became apparent that a pattern had been incised upon it in shallow but bold lines. This was cleared and deciphered, and marked in charcoal, and came out to be the pattern shown in the photograph and diagram, measuring 5×5 feet. No record of this pattern can be found, and no knowledge of it was expressed by the plantation workers, in whose plantation it was situated, who were assisting. As yet there has been no opportunity to search for comparisons to the design. The large flat stone near the two rectangular beds was examined after this pattern had been located; on the south-east corner was visible a corner of the pattern, exactly the same. This stone had unfortunately been very much weathered, so that only the corner remained.

Before leaving Bonacca, a visit was paid to Michael Rock, a ness on the north-west side a few miles from Mangrove Bight, where a previous investigator located a site. Nothing was found except some sherds lying on top of the large loose boulders which form the crown of the ness.

The two Hog Islands lie north of their attendant complement of thirteen cays: the view from the Little Hog, south over the cays to the sierras of Honduras, is one of the most delightful in the whole district. On the Little Hog appears a feature not found on the main chain: there is a small plain almost on sea-level, now a coconut garden, over most of the length of which are found small sherds and conch shells. These shells are a feature of all the sites in the locality, and must have contained one of the staple foods of the early people; they all show a similar mark of breaking: a nick near the top of the whorl. This evidence shows that the plain was inhabited, and, although Thomson and myself walked over every part of the hilly interior of the

island, there was no trace or possibility of a site there. A collection of sherds was given greater value by the finding of a small and very regularly shaped "Ace of Spades" axe.

A general summary of the problems connected with the early culture of the islands may be made as follows: Utila, from the evidence available, shows affinities in culture, as shown by the tripod on the olla, with Central America rather than with Yucatan or Mexico. The question of the urn burial needs more study than can now be given to it. The central group, Roatan, Helene, Morat, and Barberat, have very definite and numerous evidences of Ulua Valley affinities, most especially with regard to the use of marble for tripod cylindrical vessels, the designs on the painted vessels, and the shapes of these.



Hog Islands

Many imports, such as obsidian implements, must have come in to these islands, as no obsidian is to be found on them. The "Ace of Spades" implements have no comparison, as far as can be located, but would appear to be imports owing to a general scarcity of the hard and poorly stratified slate-like stone from which most of them are made; one specimen, in flint, is unique and certainly an import. The fertility of the land, and the fecundity of the sea, are enough to support a large population. Dangerous snakes are rare, while the bays are well protected by reefs. To these three islands therefore the people may have come from Honduras and Guatemala to settle, and they certainly lived there for a considerable time, judging by the depth of the sites and enormous quantities of material. That the islands were a halting-place for sea-traders there can be little doubt; water and supplies would be avail-

able for travellers from the great cities of Quintana Roo to the tribes down in Nicaragua and Costa Rica, these latter districts being a probable source of many of the amulets unearthed. Bonacca, with its stone rows and mounds, seems to have little in common with the rest, at least during the earlier period, but the sherds found in the enclosure, especially in the dry stream at the south side, are intimately connected with the central group. It is reasonable to suppose that some of the very great stocks found in one place, consisting of hundreds of vessels of similar types, in an unused condition, were traders' depots. The earth mounds and standing stones themselves suggest a reflection from the Mayan developments of geometric building. It is hoped that an opportunity will one day present itself for the further elucidation of the problems so amply provided by the material and notes at hand.

It is known that, after Columbus discovered Bonacca, a series of exterminations reft the people of the islands, sometimes removing them altogether, until the pirates who had made Port Royal their base were finally wiped out around the beginning of last century. The quantities of material and the way it lies point to sudden departure; it may well be that the original culture never revived after the initial extermination in the sixteenth century, and that life from then on until the time of the extensive pirate settlement was continued on a very low scale. It is certain however that after the destruction of Port Royal the land was virtually unoccupied until peaceful settling began, in about the 1820's. British people, settlers, and shipwrecked or stranded folk colonized the islands from that time on, and soon they became a regular British colony. British subjects from the West Indies, white and Carib and negro, came to work plantations or trade, and by the middle of the nineteenth century the colony was flourishing. It is reported that the Spanish had a hold in Bonacca, but not elsewhere to any extent. But a great tragedy was to fall upon these people: the plan to build a railway from the north to the south coast of the Republic of Honduras received both energetic support and fierce opposition from England and America; a typical protagonist was E. C. Squier, an influential American, whose small book 'Honduras' explains fully the whole matter. He and others finally managed to convince those concerned that the idea of a canal at Panama was unsupportable, and the railway scheme was adopted. £3,000,000 worth of shares were bought in England, and, armed with this, the Ministers of Queen Victoria obtained facilities for building their railway. The land and goodwill was bought for the money—and for the Bay Islands. Three million pounds, six islands, and a colony of British people went to support the railway. That part of the bargain was fulfilled, but any traveller to Honduras will have to look very hard to find any trace of the railway. What can be seen is virgin savannah and sierra, and a colony, while far to the south the Panama Canal carries thousands of tons of shipping yearly.

Each of the settlements on the Bay Islands has its Spanish Commandante, with the notable exception of French Harbour, where MacNab sits in office. The central seat of local administration is at Coxen Hole—a more suitable name to-day than Port M'Donald. It contrasts painfully with the neat and prosperous French Harbour, or the united community at Utila. At Oak Ridge, where we had our base, there are two shipyards, from one of which

new ships come forth regularly; the harbour is surrounded on all sides, with the exceptions of a gap in the reef on the south side just large enough for safety, and a shallow creek leading eastwards into Calabash Bight. There are, by mutual consent, three quarters to the settlement: the south side, which seems to rest on faded laurels, the shipyard chiefly a memory of prosperous days long gone; the east side, inhabited largely by the coloured and Spanish element; and the north side. The north side is the hub of Oak Ridge; Joe Gough's shipyard, with perhaps a ship on the slip and two fitting out against the wharf, is always busy, as skilled men, in some cases unable to read, shape a ship with an adze and their eye. To its owner and Boynton Hedges, Lord Moyne and ourselves are indebted for every facility for getting about the islands and obtaining information required. Leaf and I were provided with boats, store facilities and continual expert guidance during all our stay. Owing to his wooden leg, it was only very rarely that Boynton could get ashore to see the sites of which he knows so much by hearsay. On one of the few occasions on which he managed a short spell on land, he discovered the stone at Pulpit.

The welcome given by the English people of the islands to English visitors is so very real that it illustrates plainer than words the deep-seated desire to be restored to the British flag. Some of the old people remember the day when the Union Jack was lowered. The present generation have many adversities to fight against: the education of their children for example is well-nigh impossible. They pay a regular tax, we were informed, for a schoolmaster to be provided, but, at certain of the settlements visited, this instructor, on the rare occasions when he came, taught the children Spanish ways and Spanish language. At Coxen Hole during the summer there was a voting ceremony, and in a list of 500 names of Roatan voters over 350 are British names. Names such as Morgan, Bodden, Waterhouse, Whitefield at Utila; Gough, Abbot, Cooper, MacNab at Oak Ridge; Kirkconnell, Moore at Bonacca, at French Harbour Jackson and Arch are all common. To restore these people to the British Commonwealth would be to add again as loyal and useful a community as can exist anywhere.

Note.—The place-names used in this paper and on the two sketch maps are in the main those of Admiralty Chart No. 1219. The map of the Hog Islands embodies original survey by Mr. Leaf.

THE BAMU–PURARI PATROL, 1936

IVAN CHAMPION

Introductory note by the Editor

In the *Journal* for March 1936 we published a map to illustrate papers by Mr. K. L. Spinks on the Wahgi River Valley of Central New Guinea and by Mr. Michael Leahy on the Central Highlands of New Guinea. An editorial note on the construction of the map on p. 226 explains that the framework was plotted from Mr. Spinks' survey, and that one of the Society's draughtsmen plotted Mr. Leahy's compass bearings and resected as far as possible the positions of the points from which his panoramic photographs were taken. Details from these were sketched into the hill shaded areas upon the map made by Mr. Spinks, and the outline in the basins of the Gai River to the north-west and the Tua River to the south-east was extended.

The note went on to explain that the first sketch-map of the route of Mr. J. T. Hides in 1935 showed his route as crossing the country shown on our map between Keluwere and Yalbu, but that we could not find any agreement between the detail plotted from Mr. Leahy's bearings and photographs, and the rivers and names inserted by Mr. Hides on the map of Papua.

Owing to the condition of Mr. Hides' very arduous journey he had not been able to carry any instruments or make any observations, and the very rough track which he plotted could not be considered reliable. The following January Mr. Hides and several of his brother officers of the Papuan and the New Guinea Administration made a series of air reconnaissances covering the ground of his journey on foot, and the rough sketch-map which was made from these air reconnaissances seemed to confirm the view which we expressed at the time in our note, that Mr. Hides' route probably lay rather south and west of his supposed position, and overlapped Mr. Michael Leahy's by little if at all. We have since received the report to the Governor of Papua made by Mr. Ivan Champion upon a very extended journey which was devised to throw light upon these matters. Mr. Champion determined astronomical positions with sufficient accuracy to make for the first time a proper route-map in this region. We plotted it upon the map we published with Messrs. Spinks and Leahy's paper in March 1936 and found that where the work intersects it is not in precise agreement, but that if at about 6° S. 144° E. we shift our Spinks-Leahy plot about 2·5 miles east and 2·8 miles north their Gauil (later Kaugel; Champion's Kagole) fit the latter's narrative very well, but his map not so well: the junction of the Kagole–Nabilie is said to be 3 miles north-east of Camp 56 but plotted about 10 miles east.

Similarly the diary, which puts Mount Ialibu (Leahy's Yalbu) 12 miles W.N.W. of Camp 60, agrees with the adjusted Leahy map, but not at all with Champion's. We understand that Mr. Champion's map was made at headquarters after he had returned to his district, without the advantage of his supervision. Mr. Champion's route was designed to intersect that of Mr. Hides, and we now have the points of intersection well determined. These show that our original suspicion was correct, that Mr. Hides' was a consider-

able distance to the south-west of Mr. Leahy's route: they do not intersect at any point.

The paper which follows is condensed from the full detailed report made to the Governor of Papua. Circumstances have long delayed its publication. Mr. Champion has been at his headquarters on lake Kutubu, and we have not been able to consult him on the two points above mentioned. We feel confident that our Spinks-Leahy map of 1936, because it fits Mr. Champion's narrative, is on these two points to be preferred, and we have followed it in the sketch-map which illustrates the following, first part of the narrative. With the second part we shall publish Mr. Champion's map on the same scale as the other: when the general agreement and the relatively small differences will be appreciated. A. R. H.

WHEN the patrol was first suggested it was to ascend the Turama river, examine the country round the Leonard Murray (Bosavi) mts., and then eastward. But in February and March 1936 I made four reconnaissance flights between latitude 5° 50′ and 6° 50′ and longitude 142° and 144°, and as a result the route of the patrol was changed.

A brief description of each will make the report clearer.

We left the landing ground at Mogai in the Wahgi valley near Mount Hagen on February 1 and flew due west passing over the heads of numerous and populated grass valleys, bounded on the north by high ranges and all trending towards the south-east. At the end of an hour, and 100 miles distant from our starting point, we found ourselves over the centre of the Tarifuroro valley. It appeared to be about 25 miles wide, and 30 miles long, and more densely populated than the eastern valleys. Heavy rising clouds prevented our going south as intended, and pilot Gurney headed straight back for Mount Hagen. Mr. Hides told us that we had been north of his land route.

The next day we took a course south-west by west passing over the south shoulder of Mount Giluwe and crossing the lower portions of the grass valleys we had seen the day before. Sixty miles from Mogai we left the grass lands and flew over rough limestone country. We passed over the southern shore of a lake which we estimated to be about 6 miles long and 2 miles wide. After passing the lake the limestone became more rough and presented a curious sight from the air, a plateau of needle-pointed pinnacles and ridges running in all directions.

At the end of an hour we reached the edge of the plateau, about 15 miles south-east of the Leonard Murray mountains. Below the wall of the plateau a large river, the Turama, ran south-east, and westward the country appeared to be a heavily forested plain with a large lake about 30 miles distant.

We flew south along the rim of the limestone for 20 miles and then turned for Mount Hagen. Still flying over limestone mountains we crossed the junction of the Kikori and Mubi and the western end of the Samberigi valley, and not until we neared Mount Ialibu did we come into the grass valley systems again. This flight showed us that Mr. Hides had come south-east from the Tarifuroro valley to the Erave, or Elavo, where he turned south into the Samberigi valley and down to Kikori.

In March I went to Daru to show Mr. R. Archbold the country at the head

of the Fly river. Mr. Archbold was leading a scientific expedition under the auspices of the American Museum of Natural History; he had a Fairchild amphibian. On March 23, flying on a course of 335° true, we picked up the Wawoi river in latitude 7° 36′ and found it flowing from the direction in which

we were going. It was smooth flowing and tortuous, and appeared to be free of obstructions for many miles until we saw a large waterfall over which the whole river poured. Two miles south of the falls, and in from the right bank was a circular crater lake. Sixteen miles above the falls, and about 2 miles from the right bank, was a larger lake which I recognized as the one seen in the distance on our flight from Mount Hagen. Mr. Stuart Campbell, pilot of the Croville Company's seaplane, had also flown over it.

From the lake the Wawoi was seen to have its source in the Leonard Murray mountains, now showing up to the east. A long, sloping spur divided the Wawoi from numerous streams flowing from the northern slopes of the mountains and trending W.N.W. towards the Strickland. We saw no signs of habitations on the Wawoi.

Thirty miles beyond we flew over many villages, the houses being of the long communal type. They extended N.N.W. for about 8 miles and others were seen to the E.N.E. towards a high range running north-west and south-east. These villages were north of Mr. Hides' route. He called the mountains the Karius range.

The remainder of the flight does not concern the patrol, but it is interesting to record that our course took us through the Devil's race, that magnificent but terrifying gorge between the Blucher and Muller ranges down which Mr. Karius struggled in 1927.

On the following morning, March 24, we flew from Daru across to the Turama estuary and then followed the river up until we connected with the turning point of the flight from Mount Hagen. A good view of the Leonard Murray mountains was obtained. There was a great cleft on the southern side, between the high western peaks and the lower eastern ones. We turned on a course E.N.E. for the lake over which I had flown in February, and passed over the Kikori flowing between limestone walls. Beyond it were several valleys lying between limestone hummocks, all trending to the south-east. Some small villages were noticed 8 miles south-west of the lake.

Approaching the lake from the south, and flying high at 8000 feet, we saw small villages along the shores, cultivations and sago; a large village on an island, and canoes. It appeared to be about 10 miles long. We flew up the eastern side and across the northern end, making for the Leonard Murray mountains. Northward was the grass of the lower Tarifuroro, and below it the gorge coming south-east and swinging sharply to the west. A few houses were seen south of the gorge in wooded and apparently limestone country. Seventeen miles from the lake we crossed the Kikori again, 2 miles below its outlet from the gorge, and flowing south-east. A large tributary entered it from the W.N.W. near the gorge and the river had opened out into a wide valley with shingle spits and many islands. Two tributaries came in on the west from the Leonard Murray mountains whose long sloping spurs came down to the river. Standing out on one of these spurs was a large house.

We had reached an altitude of 10,000 feet as we flew along the northern side of the mountains with the great plateau to the north, but we did not see any more villages. We went over the south-western and highest peak of the range and looked into an old crater with the great cleft to the south. Flying south between the Wawoi and Aworra rivers, the latter flowing from the cleft, we saw two long houses several miles apart, but no more habitations until we approached the Wawoi again where it takes an easterly course towards its junction with the Aworra.

The river below this junction, and also the estuary, is called the Bamu.

During these flights I had kept a time and compass traverse, and with notes given to me by Mr. J. Taylor, Assistant District Officer of the Mandated

Territory, who had accompanied us on the flights from Mount Hagen, and Messrs. Tate and Brass of the Archbold expedition, I made a sketch which proved to be fairly accurate. It was seen that a line running south-east from the Tarifuroro valley to the parallel of 6° 30′ marked the south-western limits of the grass valleys. South of this line were rough limestone mountains with scattered communal house villages. The route of Hides and O'Malley was just northward of this line.

I then decided on a route that would take me up the Wawoi to reach the plateau north of the Leonard Murray mountains, then turn eastward and cross the upper Kikori to reach the large lake. From there the route would be generally north-east, cutting Mr. Hides' track at right angles and continuing across the grass valleys to pass between Mount Giluwe and Ialibu, and thence south-east and east to the Purari river. This would see the country south of Mr. Hides' route as far as the lake, and then northward of it.

Except that we went north of Mount Giluwe, because the country looked more interesting, we followed the proposed route throughout; and but for four days in uninhabited country on the Kurairo river we travelled the whole distance from the plateau on native tracks and with native guides, making friends with every tribe, and passed many thousands of natives.

I selected Mr. C. T. J. Adamson, patrol officer, as my assistant: a good companion and an experienced prospector.

I had intended to get thirty carriers from Mount Brown in the Rigo district, but we were unable to get the required number, so thirty prisoners were selected from Port Moresby gaol. I was glad to get these men as my previous experience with prisoners on the patrol across New Guinea had shown me that they were superior to recruited carriers. Another prisoner, Iobu, a Rigo man in Daru gaol, asked to be allowed to go. He had already served as a carrier with Hides and O'Malley. He went with me and proved to be an outstanding man. I have had many different kinds of carriers in Papua, but I have never had such a loyal band as these prisoners, and the success of the patrol is due to them.

I took a sextant and mercury horizon, and Messrs. Frank and Searle of the A.W.A. wireless station at Port Moresby made me a three-valve short-wave receiver with which time signals were obtained each evening at 6 p.m. from NPG (San Francisco, U.S.A.). The set was still working at the end of the patrol: with batteries and tin carrying case it weighed 64 lb.

Eight thousand pounds of rice were carried in sealed benzine tins, each weighing 43 lb. The rice remained perfectly fresh and one tin was still intact when we returned. The carriers preferred these loads to any other, and the tins could be left without cover without the rice being damaged. This was a great improvement on the old canvas packs.

Twenty-seven pounds of marmite were taken and saved the lives of police and carriers in July and August, when beri-beri broke out. Twenty-five per cent. of the party were ill. At one stage it was so serious that it seemed we could neither go forward nor even go back without leaving the sick men to their fate. And then we found some villages where we got sweet potato tops; the combination of boiled leaves and marmite cured the sickness.

Geographical features have been named in accordance with the rules of the

R.G.S.; that is, that where possible the native name is given, and where no native name is possible, a name is given from some distinguishing characteristic. In one instance I have departed from these rules, because neither of the above was applicable.

I left Daru on April 25 with Mr. C. T. J. Adamson and my patrol on the *Vailala*. We entered the Bamu next morning, and the following day passed into the Wawoi, joining up with an advance party under Sergeant Orai. On April 30 we went through a gorge with rocky walls 50 feet high, the river being 30 yards wide and $3\frac{3}{4}$ fathoms deep. It was decided that this was the limit of navigation for the *Vailala*, and I established camp No. 1 here, 160 miles above the mouth of the Wawoi. My party consisted of 12 police, the 30 prisoners acting as carriers, and 65 natives from Bamu villages to carry for the first month.

I left on May 3 with five canoes. Mr. Adamson remained in charge of the camp (No. 1). I camped at 4 p.m. on the left bank. The country was low lying and subject to floods, but we had passed high ridgy country during the day. Many large creeks came in from the north-east, but none on the western bank. Three miles up we came to the falls seen on the aerial reconnaissance. The Wawoi river plunged in a sheer drop for 120 feet. At the bottom were some large boulders, and below them the river opened out 100 yards wide, only to narrow again. The falls have been named after the river.

On the following morning I climbed to the top of the falls; the river was quite smooth again above them. We cut to the south to find the crater lake seen from the air, but without success. The country was ridgy and heavily forested. From below No. 1 camp to the falls the soil appeared to be good and I think that it would be suitable for rubber cultivation.

I started the next stage on May 11. We found the river running very swiftly for the first 200 yards. Two miles above the falls we came to rapids which appeared to extend for 400 yards. Loaded canoes could not be taken through them, so I decided to form No. 3 camp on the right bank. The canoes were able to make two trips a day. I cut up river to find that the country was quite flat, though on the left bank there were ridges. Several small rapids occurred above the large ones, but it was possible for canoes. We saw evidence of natives; a fish trap in a creek, and a tree which had been cut down with a stone implement. All stores were brought up to this camp on the morning of May 13 and the canoes were hauled up empty through the rapids. Corporal Jimboro was sent overland to form No. 4 camp, to which we relayed stores by land and canoe. No observations were obtained at this camp, but it is 3 miles west of No. 2. A conical hill was seen bearing 205 degrees at about 2 miles from the old village.

The next morning we followed a track which met a very large one coming from the W.S.W. and going N.N.W. We followed it in the latter direction, and arrived at a house on a ridge. I failed to obtain any information from an old man there. We then followed a large track out of the village going N.N.W., but it swung to the west, so we took a smaller track in the former direction, which brought us to the river bank in half an hour. We cut upstream over low-lying ground subject to floods, and except for the broken twigs of hunters, we saw no other tracks. The river was still smooth-flowing and 30 yards in

width. We stopped at 2.30 p.m. and returned to camp in two and a quarter hours' fast walking. Heavy rain fell all night.

The following morning, May 16, I left with canoes and Adamson went overland with sixty prisoners and carriers to form No. 5 camp. The river was in flood, but we made good progress. Many ilimo trees were seen on the banks, and breadfruit, but there was little sago. We made contact with the land party and established No. 5 camp half an hour above my farthest point reached the day before. Adamson and the Bamu men returned by canoe to No. 4.

No. 6 camp was established 2 miles above at the entrance to a stony gorge, the limit of canoe navigation. Very rainy weather set in. We made the canoes secure on the bank as the Bamu men would return to the coast in them.

Stores were relayed on land to No. 7 camp. Between it and No. 6 the country is rougher with much loose volcanic rock. The river flows between high banks and the dirty brown-coloured water changes to clear. The heavy forest still predominates. All stores were brought to No. 7 by May 22 and then relayed on to No. 8, 2 miles above. On the morning of May 26 the Bamu canoe men left for the coast. My party now comprised a total of 43, being 12 police, 27 prisoners, and two cooks. We had a hundred days' rice rations.

A mile above No. 8 camp a tributary came in on the east. Mr. Adamson and some police followed this tributary up for some miles but saw no signs of natives. In the meantime I had cut up the Wawoi. Another large creek came in from the north-west. When we crossed this creek we could see it was more open to the N.N.W. and I thought the lake must be there. We crossed over ridgy country with numerous small creeks and got down to the Wawoi again where there were rapids and long shingle beaches. The river however was fordable. Another large creek entered it from the north-east. We rafted back to the camp. In between the rapids the water was deep, with a slow current, but the rapids were shallow.

From the top of a tree on a knoll twenty minutes from the camp I had a good view of the Leonard Murray mountains to the north-east, about 20 miles away. A long sloping spur went down to the south, and on the western side the spurs sloped steeply at first and then flattened out to a long wooded ridge. Across the Wawoi to the east, 5 miles away, was a low range of hills; to the west were two dome hills. The course of the Wawoi could be seen winding north-east towards the mountains.

We spent another day looking for the more westerly lake which I had seen from the air. Instead of crossing the creek we followed up its right bank and picked up a faint native pad, then some old shelters, and finally we arrived on the edge of a swamp. Nothing could be seen from the ground, but from a tree we saw that we were on the edge of a large swamp, which was of horseshoe shape, with water in the middle. To the north the sky showed clear and it was obvious that the swamp was part of the lake.

On the morning of May 31 I left camp with Adamson and a party. We followed our previous track up the creek and crossed it. A faint native pad was picked up on the other side, its general direction being north. When we reached the top of a ridge I sent Koriki and a prisoner up a tree from which

they saw the lake, just below us. We went on and descended into a sago swamp where the track ended; we then turned back to the ridge and found a pad going round the edge. In ten minutes we came out into an old clearing. It was obvious that we were on the edge of the lake, though we could not see it. Behind the clearing to the E.N.E. was a high ridge with a track leading up to it. The police climbed a tree and saw the lake about 400 yards away, beyond a dense mass of sago palms and swampy forest. We camped here.

We left at 7.40 a.m. the next morning, and followed the track on the ridge, its general direction being north-east and E.N.E. It led over undulating forest country and across many small creeks flowing south. In two hours we arrived on the banks of the Wawoi river. The track was picked up on the other side and we forded the river and followed it, but its direction had changed to the south-east. Half a mile beyond the Wawoi we came to the banks of a large creek which was apparently the same one I had seen coming in from the east a few days previously. We crossed it only to find the track still going south-east, but a fainter one came in from the north and we turned in this direction and in a few minutes came to the banks of the creek again flowing from the east.

The next morning we crossed the creek and picked up a faint native track along which we went to the north and north-east. We went up a steep spur to find a little flat on which grew clumps of bamboo. A view to the west showed a series of flat forested ridges. The track turned to the north-west and brought us down to the Wawoi again. Fording the river we searched for a track on its right bank, but with no success. So we cut westward, up and down ridge after ridge. Each ridge was flat but dropped steeply away to small creeks flowing to the south.

After travelling for two hours we stopped, and Maniti, climbing a tree, saw the lake to the south-west. Northward and eastward nothing could be seen owing to clouds. We went on to the south-west and picked up a faint native pad which led us into our camp at the lake.

On June 10 I left camp and followed the track on which we had returned on the 2nd, but it petered out just after passing our halting place. The ridge continued to the N.N.E. and north-east. At noon we descended to a creek, the only one crossed during the morning, coming from the east and flowing W.N.W. A high ridge lay to the east across the creek. On our homeward journey we stopped on the ridge above the creek and Maniti climbed a tree. Maniti is an intelligent man and he was able to draw a rough map for me on the ground with sticks. The ridge we were on appeared to divide the waters of the Wawoi and the streams flowing to the Strickland. To the north-east Maniti saw a red landslip on a spur of the mountains and perhaps a village also. From a high tree on a ridge about $\frac{1}{2}$ mile west of the camp I saw that we were on the north-east arm of the lake. It is roughly star shape, the larger legs running north-east and south-west. It appeared to be about $1\frac{1}{2}$ miles long and $\frac{3}{4}$ mile wide. Dense cane grass surrounded the shores and between the grass and dry ground was sago and forest. A dome hill, approximately 1100 feet, the one I had seen from No. 8 camp, bore 195 degrees magnetic, about 1 mile from the lake. W.N.W. of this hill ran a long ridge. The waters of the lake seemed to be deep and free of obstructions. I could not see if a river came into it. I have named it Lake Campbell after Mr. Stuart Campbell. It

has been seen three times from the air, Mr. Campbell being the first to see it. Part of the central ranges could be seen to the north, and north by east was a conspicuous cone mountain. We spent two days chaining a base line, the terminals being on trees 60 feet above the ground, but after completing this we were unable to see anything.

On June 19 we crossed the creek visited by me on the 10th and cut up a high ridge to the north, and then up a long sloping ridge to the north-east. Next day we spent in cutting a track up the spur.

The following morning we kept on the ridge in a north-east direction towards the Leonard Murray mountains. The travelling was easy and at 2.30 p.m. we came to a native track going N.N.E. Ten minutes later we descended into a hollow and came to a clearing about an acre in extent, through which a small creek flowed to the north-west. Camp was pitched here at an altitude of 2530 feet.

There were no other tracks, so on June 22 we cut up the ridge and soon saw the peaks of the mountains, 3 miles away, across the steep valley of the Wawoi. The high south-western peak was to the east and two others stood up to the north. The spur swung towards the most northerly of them. All the trees were covered in moss and there was much pandanus. We kept up the spur which narrowed to a razor back, the undergrowth becoming very thick. To the north was a higher spur parallel with the one we were on, and we saw several pine trees on it. At 3.30 p.m. we reached a ledge with a creek and here we pitched camp at 5086 feet.

In the morning, June 23, Adamson and I with police and prisoners cut up the spur above the ledge in an attempt to ascend the northern peak. The timber was more stunted and all moss-covered; the undergrowth was trailing bamboo, very difficult to cut. We turned back at a height of 7224 feet, as a heavy mist had come down with fine rain.

We left again the following morning to ascend the mountain. The day was fine and we could see the dome hill at the lake and the plains far away towards the Strickland. At 8.45 a.m. we obtained a view to the north-west. Several high peaks of the central range were seen in the distance, and nearer, at about 25 miles, was the conspicuous cone which I had seen from No. 9. Between us and the cone was the plateau with a river running north-west. The plateau was dense forest and there were no signs of villages. At 10 a.m. I got some sun observations and a few minutes later reached the summit of the mountain where Adamson had preceded me. The highest peak was to the south, about a mile away. The Wawoi river takes its source in a saddle between this peak and the one we were on. The eastern side of the south peak dropped sheer for thousands of feet into the crater. Clouds were coming up fast, but now and again through the rifts we could look down into the crater. Near the bottom were numerous spurs, and a stream flowed to the south-east through a great cleft. We were bitterly disappointed at not getting a view to the north owing to the clouds. Three other dome tops extended to the east. I was able to get observations at noon, and fixed our position at 6° 35′ 51″ S., 142° 49′ 09″ E., altitude 7667 feet. We reached our camp at 4.30 p.m. and the next day returned down the ridge.

Strong south-east winds with driving rain prevailed for nearly a week, but

on July 2 and 3 the weather cleared and was so fine that from an 80-foot tree I saw the mountains 80 and 90 miles away. Mount Sare at the head of the Palmer, and the Victor Emanuel range could be distinguished. The cone mountain, which I think is the one Mr. Hides called O'Malley peak, was visible. North-west of the camp the country was composed of broken ridges with hills rising to 1200 feet. To the S.S.W. could be seen a range of hills forming the divide between the Wawoi and Aramia rivers. On the west, the hills dipped down to the flats bordering the Strickland.

I was seventeen days at No. 10 camp and did not see a star, but got good observations of the sun. Wireless reception was much better here. On July 10 I heard part of a message from Port Moresby for me. It was always difficult to pick up this station, though time signals came in with good strength.

A daily account of our slow progress round the north-western slopes of the mountain would be weary repetition. This mountain massif may be likened to a giant octopus, the peaks being the head, and the spurs the long arms which run out for miles with deep gullies between. Rising from low plains on the south and the plateau on the north, the peaks appear to be much higher than they are. Mr. Hides thought they were 12,000 feet high, but the highest peak is 7800 feet. They catch the vapour-laden clouds from the south-east, and on the north-western side it is always raining.

No. 12 camp was on the edge of a gorge going to the north-west, at the head of the Tomu. Great difficulty was experienced in crossing it. From a tree at No. 14 camp I had a glimpse across the plateau, the usual clouds covering all the mountains. The plateau was composed of a series of ridges all at the same height. Between No. 14 (3521 feet) and No. 15 camps we crossed a large stream flowing north. I thought that we were on the Kikori watershed, but the forest shut out everything. The river is at a height of 2620 feet and the sides are very steep.

I selected No. 16 camp above a large river running north by east. We had found a native track on a ridge after crossing numerous large creeks. This track joined a larger one from the north and turned east to the river. We followed it down the steep sides and across the river. It went east up the ridge and then turned along the top to the south-east. We went on for some hours until we stopped at a precipitous creek at an altitude of nearly 5000 feet. The track still went on and I think it is a route across the mountains to the head of the Turama river.

It was now necessary to find fresh food. On the morning of August 13 I set off down the ridge on a track, determined to find a village. At 8.15 a.m. we came to an old house with a ground floor in a little grass clearing, and continued on the ridge, still going north by east. After crossing a creek we came to a garden—the first we had seen on the patrol; it was like finding a gold-mine. There were sweet potatoes, some sugar cane, and mimia. Here I had a good view of the Leonard Murray mountains. The track led out of the garden, through some scrub, and then to a ridge where houses stood. Natives ran away at our approach. The sides of the ridge sloped gently down on each side; on the western was a small river flowing north, with a number of young sago palms on the bank. We followed the track to the north in the hope of getting into touch with these people, but failed to do so.

We left the following morning for the village and I made camp No. 17 here. No natives were seen, but they had returned and taken two knives which I hung at the house, and all their sago. Fresh food was necessary for the sick men, and I dug for potatoes in the garden, but we got a few pounds only. However, we fed every one on boiled sweet potato leaves. It was noticeable that the villages are built on strategic positions. The entrances face the tracks, and from the verandahs all the approaches can be watched. The sides of the ridge are cleared of standing timber.

On the morning of the 18th I sent the corporal in charge of a party to make sago from the palms below the ridge. At 2 p.m. there was a sudden commotion and the corporal appeared with eight strangers. Six of the men had light bronze skins, and were short and thick-set and wore wigs of human hair. The other two were taller and darker and their hair was worn in little ringlets. Their features were entirely different. The next morning about twenty men came into the village; there were the six wigged men and another like them; the remainder were dark skinned. The wigs were of human hair and hung low at the sides. I discovered that the wig men were visitors who came from the north. They indicated that they were travelling to the east on a trading mission and pointed to the large bundles of tobacco they carried.

The next morning I sent Adamson to form a camp at a village I had found a few days previously, and we learned that far to the east was a trading centre and that tobacco leaf was exchanged there for shells.

I left the village the next morning for No. 18 camp (6° 28′ 05″ S., 142° 50′ 56″ E.). From a native I learned that the Leonard Murray mountains are called Bosavi, and that a large river to the north-east and east is called the Gigio; the river below us was the Kuru, and the river on which No. 16 camp was situated, the Wanu. Farther to the east was a river flowing from Bosavi called Bifu. All these rivers flowed into the Gigio. The cone mountain across the plateau to the N.N.W. was called Sisa. Sweet potatoes are here called *saburu*, which is interesting. The natives on the Palmer river call sweet potatoes *saburup*, so do the Bolivip natives at the head of the Fly, though their language is quite different.

I sent Adamson away on August 25 to form No. 19 camp somewhere on the track going east by south. This is apparently the trade route. He returned in the afternoon and said he had selected a camp on a river, which I took to be the Bifu. Many tracks branched away from the main track, but they all led to old village sites. The next day I followed the track leading from the village to the north. It crossed the Kuru river and took a north-westerly direction over old garden grounds. Dropping down from the knoll on which they lay, we arrived at a village on the banks of a river which flowed from the north-west and twisted to the north-east. The banks were high and the river was deep and smooth flowing. On the northern bank was an old village. Adjacent to the village was a very large garden planted with bananas, and there was a smaller potato garden. I estimated the area of old and new gardens to be about two hundred acres. On our way back we had a good view from the knoll. North-west towards Mount Sisa were some more clearings on the foothills of these mountains. Koriki pointed out that Hides had passed through the clearings and that there were villages there. We saw

Canoe at Lake Kutubu

Peninsula and islands, Lake Kutubu

Hegigio river, where Katue swam

Bosavi Peaks from north-east

Entrance to Long House, Wasemi Island

Grass Valley men at Wasemi Island

more clearings to the south along the base of Bosavi (the Leonard Murray mountains).

When it was clear we got a good view of the limestone barrier to the north-east, trending south-east. To the N.N.W. Mount Sisa stood up boldly with several other peaks north-west of it. The Gigio flows from Mount Sisa south-eastward along the bottom of the barrier. Southward the Bosavi peaks were prominent, and westward the plateau dipped towards the Strickland.

We moved to camp No. 19 on August 28, and to No. 20 on September 2. Adamson and I travelled east by south on the main track for 4 or 5 miles. After crossing the Bifu we found a large house on a well-cleared spur above the river. But as usual with these people little of the clearings are planted, and seem to be made for defensive purposes. These natives are mainly sago eaters; their gardens are small and they do not burn off. The soil on this plateau appears to be good but the inhabitants have no agricultural knowledge.

On September 4 Adamson left to establish No. 21 camp. He followed the track from the old house and about 2 miles farther on, in an E.N.E. direction, came to a well-cleared spur with a house on the end. He had a good view from north-west to east and saw about 5 miles away a large river flowing south-east which could only be the Kikori, or Gigio, as these natives call it.

Six natives visited me at No. 20 camp. They call the *mairi* shell *kava*, and European beads *herevesuma*. They told us that these things came from places to the south-east across the Gigio called Kedego and Kewa. One of them jabbered away in a different language and said it was the language of Kewa, but I could not find out how far Kewa was. They told me that to the south, over Bosavi, is a river called Merebo, which I think is the Turama.

I left for camp No. 21 on September 6. I recognized the village here as the one which I had seen from the air as we crossed the Kikori. When the weather cleared we had a magnificent view. North-west the cone of Mount Sisa dominated all; east of it was the hump which I have called the Whale-back, and then the serrated limestone barrier over which Hides had crossed to the Tarifuroro. Eight miles to the north was the outlet of the gorge. North-east, across the Kikori, a range of about 2000 feet elevation ran south-east gradually rising to a bluff of about 4000 feet. Hides called this the Humphries range, and the bluff, Mount Simoi. High mountains formed the eastern side of the Tarifuroro; beyond were more high mountains, their outlines had softer curves than the sharp peaks of the former. Away to the east were precipitous ranges; and to the south-west, peeping over the forest, were the conspicuous domes of Bosavi.

I sent Adamson down to the Kikori to find a crossing. A youth told us that the large river was the Hegigio and it went south-east; lower down it ran through high gorges. A river flowing towards the Hegigio below the village, and which Adamson was following, was called the Mungasu. The Bifu was farther north. He said the track went south-east, crossed the Hegigio, and went on to Kedego and Kewa.

On the morning of September 11 Adamson sent a message to say that he was camped on the Hegigio at its junction with the Mungasu. The river was very wide with islands, and the arm he was on was 90 yards across. There was no way of bridging it as the banks were low, so the police made a canoe.

I joined Adamson at the Hegigio; it was flowing south-east by east and was in flood. The current was about 15 miles per hour and I did not think it would be wise to attempt a canoe crossing. Had there been sago here I would have waited for the river to go down, but it might have meant a wait of several weeks as heavy rain fell nearly every day. We decided to return to camp No. 21 and follow the track to the south-east. There was sago there and probably a suspension bridge as the track was undoubtedly the trade route. We returned to camp No. 21 (6° 31′ 14″ S., 142° 56′ 04″ E.) on the 12th and the next day relayed stores to camp No. 22. The next morning stores were taken across the river and camp No. 23 was made near some sago.

At camp No. 22 an old man told us that the river was called the Menabu and that it flowed into the Hegigio. The track went east by south and across the Hegigio to Kewa. He showed us, by standing on a log and making a sweeping motion with his arms, that there were canoes at Kewa, five days' travel. He got two small sticks and stood them up, then a piece of twine, and showed us by signs that a suspension bridge crossed the Hegigio river. We moved all the stores across the river to camp No. 23 the next morning. The Menabu was 1035 feet above sea-level.

The following day Adamson and I followed the track on the ridge. It went north-east for an hour to some sago and then turned to the south-east. We crossed a river flowing north-east and found a native shelter in a patch of sago. At 12.25 p.m. going east we reached a ridge. From here the country sloped away to the east, and Koriki from a tree saw the Hegigio about 6 miles away.

Camp No. 24 was made on the ridge at a native shelter, at 1517 feet. We had only 1100 lb. of rice left, sufficient for nineteen days.

We moved all stores to camp No. 25 on September 22, altitude 1256 feet. The sago here was poor and only a little was made.

We followed our previous track from camp No. 25, but after leaving the ridge the track ended. I cut E.N.E. by compass and soon came to limestone. I knew that we should meet it some time and now I felt a chill run down my spine. But it was easier than I thought it would be. The country was undulating and gradually sloping to the east. At 9.5 a.m. we reached a large creek flowing in a miniature limestone gorge 20 feet deep. We crossed lower down, where the creek was flowing E.N.E. At 12.30 p.m. it flowed out of the gorge and opened out. We left the rice under a fly and returned to camp.

The next day we brought more stores down and the police found a track running parallel with the river for 1½ miles. It then crossed the river where it was smooth flowing with a sandy beach. I made camp No. 26 (571 feet) here and sent carriers back for the remainder of the stores.

The following morning Adamson and I with four police crossed the creek and picked up the native track on the left bank. The creek flowed east by south through limestone. There was no limestone on the left bank and the track brought us to an old village. We had been travelling north-east, but from here a broad track went E.S.E. and we arrived at the Hegigio; and great was our joy when we saw a suspension bridge spanning the river. But our hearts sank again: there were but three strands of lawyer cane. The river was

80 yards wide and very deep; it had rocky limestone banks, and the current was very fast with big whirlpools. I decided to have the bridge repaired before attempting to cross. We returned to camp No. 26 and the next day moved to camp No. 27 in a sago patch. The following morning I sent men down to the river to strengthen the bridge, but at 9 a.m. Sergeant Orai came back and said that it had been cut down. We hurried down to the river and saw the bridge vines trailing in the water on the opposite side. I then made an unsuccessful attempt to swim the river. The following two days we spent in attempting to cross the river by canoe, but the Hegigio defeated us.

On September 30 I left with Adamson and a party to follow a small track going down parallel with the river. The track went to the south-east through limestone and at 2.30 p.m. we camped. The next day the track brought us on to a ridge above the Hegigio, and with high hopes we descended to the river and found an old bridge site. For about 50 yards the river ran through a gorge 40 yards wide. It was deep, but the current was not running at more than 8 miles per hour. An attempt by A. C. Katue on the following day to swim across was unsuccessful. There were no tracks going downstream. Our final effort had failed; the Hegigio remained unconquered.

The next day, October 3, we returned to No. 27 camp. I decided to go upstream; there was a faint hope that a crossing would be found near the gorge. If that failed we would return across the plateau and go down to the Strickland. Adamson left next day to follow a large track which would most likely take him to the villages on the Menabu river where we might get the help of the local natives. He sent a note that he was camped at the junction of the Hegigio and Menabu rivers. Apparently he had taken the wrong track, but this proved to be fortunate.

I left with the last of the stores next day, and went up along the banks of the river to camp No. 28. There were wide shingle beaches and the river was falling. My hopes rose; perhaps we would be able to cross with a canoe. Adamson left first in the morning and reached the junction of the Mungasu and Hegigio. The river was still falling and the police were sure that we could get across with the canoe. I got up to this camp, No. 29, at 2 p.m. and found the police hard at work on the canoe which had been started on September 11. In the morning the canoe, 30 feet long, was launched. Light rain was falling but the river was still low. We could only see one channel; the larger one was behind a big island and we did not know what it was like. However, we got every one and all the stores across to the island in seventy minutes. The eastern channel was 90 yards wide and deep. The current was strong but we crossed easily. At last, October 7, we had crossed the Hegigio after twenty-six days.

Camp No. 30 was pitched on a knoll above the river and we had a good view of the village at camp No. 21. Katue and Koriki found a native track behind the camp which they followed to a patch of good sago. We made camp No. 31 (1163 feet) there the next day, and camp No. 32 (804 feet) at the river where there was more sago. On October 11 we moved up to camp No. 33 in limestone country where there was a small house and some sago.

Adamson left the next morning to follow a track to the north-east, returning

at 1 p.m. with good news. The track had ascended a limestone range which was very rough. The range appeared to slope away to some low hills about 15 miles distant. While descending he met a middle-aged man and a boy, and was told that the track went south, swinging south-east to the Mubi, and that on the Mubi there were canoes. The old man also showed him a track going north-east, which he said went to a place called Iobu and then to the Mubi. We seemed to have found the track to the larger lake.

We went up to the small village the next morning. It was a very steep climb for half an hour and then we passed through bad limestone with many craters. We had a fine view of the plateau from camp No. 34. The tops of the Bosavi mountains were cloud-covered. It is a pity that this huge plateau, which Hides has called the Great Papuan plateau, is so inaccessible. The soil appears to be very fertile and with the rainfall would make fine rubber land. We saw as many abandoned villages as occupied ones. I estimate the population at less than a thousand natives. I got star observations at night for the first time for many weeks.

In the morning, October 14, I took the track leading to the north-east. We reached the top of the range in twenty minutes and I was startled to find that to the east was a limestone depression and another rough limestone range beyond, about 2 miles away. To the north were the mountains of the Tarifuroro and the gorge. The track went down into a basin surrounded by limestone hills, but the soil was good. I camped here and the next day followed the track across the rim of the basin and over undulating limestone country in a north-easterly direction. Beyond this were low hills and farther on high mountains.

We remained here on October 16 repacking the stores. This was the end of the relay system: the carriers had relayed stores for 90 miles from No. 8 camp, and in five months had travelled nearly 700 miles. We had eight days' rice rations left and our objective lay 200 miles away. By halving the morning and midday meal the rations would last eleven days. I had however a good assortment of trade, and I knew that beyond the lake were the grass valleys with a large population. The next day we had only gone a few hundred yards when we found that the heavy rain had made a deep swamp in a depression, which we had to bridge. At 1.15 p.m. after passing through some limestone country we descended to low-lying land with pandanus and breadfruit growing. We went on through flat grass country and climbed a limestone knoll on the top of which was a large communal house. There were a few men to be seen, but they called to others, and in a short time thirty men and youths were about us. They showed us the track going north-east to the Mubi which was three days away, and beyond the Mubi was the Wage river, another three days' journey. I have these villages marked on my aerial map.

On October 18 the man who had told us of the Wage offered to guide us. We learned that it was only one day to a place called Kudubu where there were canoes. Kudubu was evidently the lake. The track was well defined and we travelled E.N.E. over a plateau. There was no limestone; the creek beds had volcanic stones. We crossed a large creek flowing west and climbed a spur to reach a range about 3000 feet high. From a tree, Maniti saw the lake to the east with high mountains beyond. The track went down a small

creek in which there were several seams of coal, and joined a larger creek which we followed in an easterly direction for several hours. We passed through limestone again to come out on to flat forest country, and later climbed to the top of a limestone knoll, from which we saw the northern end of the lake $1\frac{1}{2}$ miles away. Beyond the lake was a valley, and a high range of mountains running south-east. They were very precipitous and had that ugly look which denotes limestone. But to the N.N.E. the ranges had an easy slope. A youth we had met called the lake Kutubu, and the valley beyond it the Mubi, and beyond that the Wage.

The next day we continued on a canoe track to the south-east, until we came to a narrow waterway which brought us to the banks of a clear stream flowing at a mile an hour. It was 90 yards wide, very deep, and flowed to the south-west. We went back to dry ground and found a shelter near a sago patch.

On October 20 police and prisoners started at daylight to make a canoe. Natives informed us that they were from Kutubu and the Mubi river lay beyond, then the Wage and the Augu. The Augu joined the Wage and flowed into the Kiko. The Foi-i and Nigima people were to the south-east on the Mubi, and to the south was Kewa. They took the sergeant to the lake and pointed out their village on an island. Our camp by the lake (No. 38) was in 6° 23′ 10″ S., 143° 14′ 26″ E.

On October 21 our canoe was launched at daylight. We went down to the landing intending to visit the lake in it, but when I saw the fine large canoes of the lake people I decided to travel in them. It was a glorious morning, the air crisp and bracing. We paddled up the river, which is called Digimu, and we were told that it flowed into the Kiko. Over the trees we could see the blue limestone range towards the Wage. We travelled for $\frac{3}{4}$ mile and came into the lake. I will never forget that first sight of it. To the N.N.W. was the gorge of the Tarifuroro and the high mountain mass on its eastern side which gradually sloped to the south-east in long flattened ridges to form the Waga Furari. Beyond this plateau were high ranges. North-east a serrated range went south-east to end in a series of domes and castle-shaped peaks; westward the ranges were lower, gradually rising towards the Tarifuroro. The water of the lake was blue and in the middle rose a green island.

I took soundings but could not get bottom at 20 fathoms. As we approached the island we could see many figures at the entrance to the long house, and there was our old guide beckoning to us. Fifty men sat on the verandah of the long house. I moved towards the entrance, but the guide shook his head so I did not go in. The wall of the verandah was decorated with hundreds of pig jaws. Separated from the long house by a street 15 feet in width was a row of fifteen houses, each 18 feet long by 12 feet wide. Koriki recognized a Waga man sitting on the verandah. He had a wig covered by tapa cloth. His face was broad and flat, contrasting with the long faces of the lake men, and he was of shorter stature. When we went down to the canoe landing the men brought sago and sold it for white beads. We later bought more sago so that we had about a week's supply on hand. I bought the largest canoe with a large knife and told the natives to bring canoes in the

morning as we wished to cross the lake. The canoes are well built, the largest being about 35 feet long, with high bluff bows; they are very light.

On October 22 a large fleet of canoes arrived and we were able to move across to the north-east side of the lake. The natives took us to a beautiful little bay and told us the Wage track went from here.

The next day we paddled down the north-eastern side accompanied by several men in three canoes. The shores were steep to, and there were many small gardens containing sweet potatoes, sugar-cane, and taro. We went down the south-east arm of the lake where a long limestone peninsula juts out and ends in several cone-shaped islands on which pretty red and orange flowers grew. We crossed to a village on the western side called Tugiri. We learned that the island where the old man lived is named Wasemi. Near Tugiri is Iokobu.

We examined the northern end of the lake on October 24. Two limestone spurs come down from the north-west with a valley between, but though there is probably a river the entrance is blocked by high reeds and we could not detect any current. Probably water comes into the lake underground; except for small creeks we did not see any large river coming in. There is no current in the lake.

The next day we went down the long south-western arm. At the end of it is a river called Samaka flowing south-east, but the outlet is covered in dense reeds with patches of sago. There was a village on the eastern side called Kara-a. Kewa lies to the south and a place called Damainu is down the Samaka river, which flows into the Kiko. We paddled up the south-western side which is limestone and comes sheer down to the water. About 2 miles up we came to a small island, separated from the mainland by a deep channel 50 yards wide. The island, called Kesi, is limestone, about half an acre in area. There was a long house 70 feet in length and ten smaller houses in a row. As a storm was approaching, we left the village and headed up the lake, but we had only gone a few hundred yards when a heavy squall came down. Our canoe escort guided us to a limestone cave where we sheltered. The water is so clear near the shore that we could see everything on the bottom.

On October 26 we remained in camp. We saw some men with old blunt tomahawks which they said come from Okani. I think the lake is a central trade market and the trade comes from the Okani to the Mubi. Unfortunately I was unable to get any observations at the south-east end of the lake, but I estimate its length between 10 and 12 miles. Its width near the northern end is $1\frac{3}{4}$ miles, but it is slightly wider, about 2 miles, in the centre.

(*To be concluded in the* Journal *for October*)

PROBLEMS OF EGYPTIAN GEOGRAPHY

CONTRIBUTIONS TO THE GEOGRAPHY OF EGYPT. By Dr. J. BALL, O.B.E. *Cairo: Survey and Mines Department, Egypt*, 1939. 11×7 *inches;* xvi+308 *pages; illustrations and maps*

EGYPT has been fortunate in her official geologists, among whom the names of Drs. Hume and Ball are indissolubly coupled. It has been written of them that they regard survey as a religion and have done more solid and lasting work in Egypt, extending from the days of Cromer, than any other group of officials. Dr. Hume is producing volumes of a monumental work on the geology of Egypt, and now this book of contributions by Dr. Ball to the geography of Egypt is very welcome. Opening with brief geographical and geological outlines, the later history of the Nile is dealt with in greater detail. This brings us to chapters on the matter transported by the Nile in solution and suspension, and on the alluvial land which is the river's gift to Egypt. Finally, more than one-third of the book is devoted to the hydrographic problems of the Faiyum and its lake.

In tracing the changes that occurred in the Nile Valley since the beginning of Pleistocene times, the conclusions of Drs. Sandford and Arkell are generally followed.[1] Valuable tables and diagrams show the sequence of sea-levels. The land gradually rose 197 metres from Late Pliocene until it was highest, 43 metres above present levels, in Middle Mousterian times, since which it has sunk to what it is now. These levels depend on the results of borings at Rosetta and Zagazig, and Dr. Ball assuming slopes has worked out the corresponding depths of the rock valley beneath the cover of alluvial deposits at Beni Suef opposite the entrance of the Faiyum. In the absence of definite data such estimates are of interest, but it is clear that we require a series of borings across the valley at Beni Suef to tell us the depths of the alluvial deposits. The implications of the changes of level on the distribution of land and sea are considered, but unfortunately the map of Bahr-el-Mandeb given is not the most recent.

In order to explain the vast quantities of silt deposited by the river in Egypt in early Sebilian times, he suggests the existence of an extensive sheet of water, Lake Sadd, upstream of the Sabaloka or 6th Cataract, with an area of 230,000 square kilometres, from which he supposes the entire discharge of the tributaries now combining to form the Blue and White Niles was evaporated. It is suggested that until the water of this lake found its way through the Sabaloka Gorge, the valley in Egypt was eroded by the water of the Atbara together with contributions of local streams, possibly under conditions of greater rainfall. At the Sabaloka the Nile for a distance of 12 kilometres flows through a gorge with rocky slopes rising more than 100 metres above it. Dr. Ball postulates a barrier within the gorge of hard rock such as forms the slopes, rising to about 31 metres above the present high flood-level, to retain Lake Sadd. In the opinion of the reviewer, the area shows no evidence for such a lake; and there are difficulties about the way its basin could have been formed, a sufficiently sudden erosion of the presumed rock barrier in the gorge, and the interpretation of the ancient Nile records at Semna on which Dr. Ball relies. But to argue these questions is beyond the scope of a review.

[1] K. S. Sandford, and W. J. Arkell, 'Paleolithic man and the Nile–Faiyum Divide' (Oriental Institute Publications, 'Prehistoric survey of Egypt and Western Asia,' vol. I), Chicago 1929; 'Paleolithic man and the Nile Valley in Nubia and Upper Egypt' (*ibid.*, vol. II), Chicago 1933; K. S. Sandford, 'Paleolithic man and the Nile Valley in Upper and Middle Egypt' (*ibid.*, vol. III), Chicago 1934.

Discussing the matter carried in solution by the Nile, the author states that no complete analysis has yet been made, though he presents a mass of data. Comparing the quantities of matter in suspension, he finds that of the 110 million tons passing Wadi Halfa annually, nearly half has disappeared from the water passing Cairo. At Aswan, there is nearly 7 metres of mud resting on the alluvial sands, while in the delta there is about 11 metres. It is estimated that in the neighbourhood of Cairo, mud has been deposited and the river bed has been rising at a rate of 9 centimetres a century during historic times. To explain the presence of this superficial layer of mud in the Delta, he suggests that the slope was formerly steeper and mainly sand was deposited. But the deposition of an upper layer of mud covering the sand is a normal result as the river swings across its valley and is the rule along the main Nile between the cataracts.

In dealing with the problems of the Faiyum, Dr. Ball made use of the contoured maps issued in 1929 by the Survey Department and also the results of borings by the Geological Survey across the inlet channel. The rock channel was found to be only 17 metres deep [We think *deep* should read *below sea-level*. Ed. *G.J.*], and this disposes of the possibility of the depression having been eroded by streams flowing into the Nile. Like the neighbouring Rayan depression, it must have been eroded by the wind. Dr. Ball accepts the evidence of Herodotus that for a considerable portion of the time between 2000 B.C. and 450 B.C. there was annually a flow into the Faiyum during six months and then the water flowed back. It is estimated that the flow into the depression was about 6 cubic kilometres: an average of 360 cubic metres a second during that period. At the peak of the flood it must have been much greater, perhaps more than double, and the question naturally arises as to how such a stream was controlled. The silting that must have occurred at the inlet is referred to and it is suggested that the rapid rush of water of the next flood season would have cleared it. In view of the tremendous silt clearance required at the entrances of the relatively small feeder canals for basins and also experience of the manner in which backwaters are closed by silt, the problem of annual supply does not seem so simple.

The contouring has shown that the sites of a number of Ptolemaic towns occur along a level a little more than 45 metres above that of the present lake. Part of a regulator of that period is still in use. The composition of the water in the Birket el Qarun Lake is considered, and it is shown that there has been a marked increase in the salinity during the last thirty years. The Nile perch has practically ceased to exist, but the grey mullet has been introduced from the sea and now contributes a large proportion of the fish supply. At present levels it seems there is no loss of water and salt by seepage from the lake; but there probably was at higher levels. There are hydrographic problems of the Faiyum still unsolved.

The book is largely a discussion of others' work in the field, and is a mine of information replete with facts and references to literature, some of which is not easy of access; and if we cannot agree with all the author's conclusions we are nevertheless under a great debt to him. G. W. GRABHAM.

REVIEWS

EUROPE

GÉOGRAPHIE DU MIDI AQUITAIN. By PAUL ARQUÉ. *Paris: Editions Rieder*, 1939. $7\frac{1}{2} \times 5\frac{1}{2}$ *inches; 270 pages; illustrations and sketch-maps. Fr.45*

This small volume, illustrated with maps and photographs, gives a useful survey of a part of France that both historically and geographically is of special interest. Behind the regional unity of the area the local geographical diversity is emphasized, from the fringes of the Central Massif to the Pyrenean crests, the solitudes of the Causses or forests of the Landes, the stony wastes of Périgord or well-watered valleys of the Charente and the Garonne. All the regions have their local colour and character, yet in spite of their diversity some features of similarity can be traced.

The first section deals with the general background, both physical and human. The second section gives a detailed regional analysis of the many sub-units, from which the reader can build up a clear impression of the geographical landscape. Toulouse and Bordeaux, the two chief urban centres, are discussed at greater length in separate chapters.

The general study of the region brings out interesting facts regarding the changing character of the population in the whole region. Both immigration and emigration still occur, the former masking the full extent of the latter. For instance, in the years 1931–36 the total gain was about 11,000, but the foreign element increased by 37,000. The total foreign element makes up 4·7 per cent., which, though not as high as that of industrial France to the north-east, or of alpine or mediterranean France, is high as compared with that of agricultural regions adjacent to south Aquitaine. Since 1851 there has been a rapidly increasing foreign element in this region. Before 1914 this was almost entirely Spanish, but after the war immigrants came from all parts of Europe, to include groups of Poles, Spaniards, Italians, Portuguese, Belgians, Swiss, and Russians. Some have engaged in industry, but a marked feature is the proportion of the foreign element that has settled to agriculture, notably from amongst the Poles and Italians. Reduction in population on the other hand is due to both emigration and to a falling birth-rate. The latter is due more to economic than to purely social causes. The present limited opportunities in a life that is purely agricultural and becoming increasingly pastoral, and the decline in and extinction of local and rural industries, have led the agricultural population to regard fecundity as a misfortune: "Economic sterility explains the human sterility of the region."

A. GT.

KUNGL. SVENSKA VETENSKAPSAKADEMIEN: Förhistoria, grundläggning, och första organisation. By BENGT HILDEBRAND. *Stockholm: K. Vetenskapsakademien*, 1939. 10×7 *inches; 672 pages* (*Noter, bilagor, etc.* 673–886 *pages*)*; illustrations*

The Swedish Academy, founded in 1739, is among the youngest of such institutions, and it is therefore natural that the author of this account of its foundation and early organization should devote more than a quarter of his book to its forerunners. One of the salient points is the influence on its founders of the Royal Society, with its interest in practical and utilitarian problems. Insistence on the use of the vernacular language, partly derived from the example of the Royal Society, severely restricted the influence of the Academy, and a further limita-

tion was their concern with purely local problems, such as the possibility of cultivating the silkworm in Sweden.

A large part of the book is devoted to details about the personalities and activities of early members of the Academy and to the constitutional and administrative problems which they had to face; comparatively little attention is paid to scientific work, and only a small section deals with the Academy's publications.

There are copious notes, a bibliography of forty-seven pages, an index of personal names (but no general index), and nine appendices, mostly early documents, though the ninth, an extract from the Proceedings of 1739, is a fascinating description by Linnaeus of the pestering of reindeer by warble-flies.

M. S.

THE DUTCH: a portrait study of the people of Holland. By ADRIAAN J. BARNOUW. *New York: Columbia University Press*, 1940. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xii +298 *pages.* 20*s*

Professor Barnouw's work will be welcomed by those anxious to understand the spirit animating the Dutch in their present trials. He is careful to make no exaggerated claims for them, and to admit shortcomings, yet his "portrait study" of these "obstinate individualists," practising without heroics their ideals of tolerance and impartiality, is attractive, and in its way moving. Without entering into excessive detail his chapters cover adequately the characteristics of the country: home life, politics and religion, literature and art. To most readers his account of twentieth-century movements in Dutch art and literature, amounting almost to a modern Renaissance, will probably prove the most interesting part of the book, and should dispel the erroneous idea of the Dutch as a stolid rather slow people, living almost entirely on the memories of a glorious past. In the difficult question of the relation of the written to the spoken language the author is conservative, maintaining that, as the written standard is that of Belgian Flemish, present speech, which is not uniform, should not determine orthography; he is also conservative in defending the use of the words "Dutch" for the people, and "Holland" for the country.

Perhaps because his own interests are historical and literary, the author has left some aspects of Dutch life untouched. More could have been said of the achievements of scientists, of rural and industrial life, and of the colonial empire. Nevertheless, as an interpreter of his countrymen, whose destiny at critical periods of European history has often been closely interwoven with our own, he has achieved considerable success.

G. R. C.

THE SCENERY OF SIDMOUTH; its natural beauty and historic interest. By VAUGHAN CORNISH. *Cambridge: University Press*, 1940. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xiv+86 *pages; illustrations and map in pocket.* 7*s* 6*d*

Dr. Vaughan Cornish's happily worded book should appeal to all who have associations with the Sidmouth district. Life-long admiration for the scenery of this quiet south-east corner of Devon and the inheritance of property at Salcombe Regis led the author to select a small area for the application of those general principles he has so often set forth in his work on the Council for the Preservation of Rural England. He well describes the high, imposing red cliffs, the fine storm-waves which develop at times in the bay, the mild climate and rich soil, and the hills which stretch away inland towards Honiton and the beautiful Blackdown ridges along the Somerset border. It is said that visitors from colder and less fertile parts of the country often express surprise at the rich colour and large size of the primrose blossoms around Sidmouth in the

spring, though this might be equally true of many localities in the far west of England.

The statement on p. 31 that this is the only considerable area in England where the Greensand, overlying Red Keuper Marl, crowns the hill tops instead of being capped with chalk, is not perhaps quite sufficiently clear; the reference is to the Upper Greensand only. The distinction between the Upper and Lower Greensand is not always kept in mind and the high conspicuous ranges in the south-east of England of Greensand (Lower) running parallel with the chalk Downs are themselves entirely without chalk capping.

The author's sketch opposite p. 34, "Sidmouth Gap from the Sea," drawn in 1896 from a distance of 9 nautical miles, is most interesting. In this the cliffs of Salcombe Hill and Peak Hill, so prominent at Sidmouth, are not conspicuous, being backed by the level line of the inland plateau in which the Gap appears as a well-marked notch. The map facing p. 8 is confined too much to the area of the Sidmouth Urban District. Thus it shows Ottery St. Mary but not places considerably nearer Sidmouth such as Tipton St. John and Newton Poppleford. A folding panoramic sketch of Sidmouth in 1815, drawn by the author's great-great-uncle Hubert Cornish, is very pleasing. L. C. W. B.

FEROX AND CHAR IN THE LOCHS OF SCOTLAND: an inquiry. Part 1. By R. P. HARDIE. *Edinburgh: Oliver and Boyd*, 1940. 8×5½ *inches;* xx+226 *pages.* 7*s* 6*d*

This book adds little to available knowledge of either geography or biology, but to the angler it may have value as a simple guide to the lochs of Scotland, as it contains notes about the fish which occur in them. The bulk of the matter has been taken from existing studies of the Scottish lochs, particularly Sir John Murray's well-known Bathymetrical Survey (1910). The thesis propounded in the Preface is that the presence of char in lakes is often associated with the presence of large cannibal trout known as *ferox*, a name which is retained in the title of this work, though it designates a habit rather than a distinct species. There is little new in associating char and these big trout, since both require deep water, and no doubt char in common with small trout are preyed upon by the large trout. After perusing the somewhat inconsequential quotations and notes describing the numerous lochs, the reader is left to draw his own conclusions without any assistance; the few short passages in which the author was tempted to discuss the significance of facts tend to be highly problematical.

It is probable that many char caught in Scotland are passed off as smolts of salmon or sea-trout, and one would have thought that, in a book of this nature, the difference between char and trout would have been mentioned as an aid to the angler. Since its isolation in deep lakes at the end of the Ice Age, the original migratory char has become differentiated in the British Isles and elsewhere into a number of species or races. These fish would certainly repay further study, and from this point of view Mr. Hardie has done some service in cataloguing the Scottish lochs in which they are known to occur. E. B. W.

ASIA

STUDIES ON THE ICE AGE IN INDIA AND ASSOCIATED HUMAN cultures. By H. DE TERRA and T. T. PATERSON. *Washington, D.C.: Carnegie Institution* (*Publn.* 493), 1939. 11½×9 *inches;* xii+354+liv *pages; illustrations and maps*

The Yale-Cambridge India Expedition of 1935 was carried out under the direction of Hellmut De Terra (Carnegie Institution of Washington) in association

with T. T. Paterson (University of Cambridge) and P. Teilhard de Chardin, and was assisted not only by the Carnegie Institution, Yale, and Cambridge, but also by other bodies including this Society. Its main object was to explore a section of difficult borderland of geology and archaeology by attempting to correlate the records of the Ice Age in the Himalaya of Kashmir with the traces of Stone Age man in other parts of India. This volume is the main report of the expedition: it is comprehensive, copiously illustrated by text-figures, including a number of lucid block diagrams by the author, maps, and plates depicting landscape features and artefacts. The bulk of the text is by De Terra, but with important sections by Paterson.

The first and larger part is devoted to the Ice Age in south-western Kashmir. It is, perforce, wholly geological and geomorphological since records of palaeolithic man are lacking from Kashmir. While man invaded the foothills of the Punjab, it appears that the mountain barrier of the Pir Panjal prevented the discovery or settlement of the valleys beyond until post-Glacial times. In general, the work of the expedition confirms Dainelli's conclusions that there were four main glaciations and three interglacial periods. Dainelli tentatively correlated the Himalayan glaciations with the Mundel, Riss, Würm, and post-Würm I of the Alps; De Terra considers them older. It is impossible to note the many important discoveries of the expedition, but some of the evidence of Himalayan folding extending into post-glacial times is of extraordinary interest and to similar late movements belongs the extensive tilting of the Kashmir valley. In view of the enormous thickness attained by some of the later Tertiary deposits in northern India, it is scarcely surprising to find that the gently folded lacustrine beds known as the Lower Karewa and deposited in a single inter-glacial period reach a thickness of 2600 feet.

Part II is devoted to the Pleistocene geology and Stone Age cultures in north-west and peninsular India, and embraces the results of field studies made in Potwar (Punjab), Sukkur, and Rohri (Sind), the Narbada Valley near Hoshangabad, and near Madras City, though only brief notes are given of the Sind and Madras areas. It is considered that the stratigraphical sequence in Potwar renders entirely untenable the theory of an "Indo-Brahm" river put forward both by Pascoe and Pilgrim, and that the huge thickness of Pleistocene and recent deposits is to be explained by deposition from lateral streams. The earliest artifacts are large massive flakes with little retouch, and are found towards the top of the Boulder conglomerate (second glacial of Kashmir), whilst tools of Acheulian types appear in the Second interglacial deposits. The distinctive implements of the area are however those fashioned from pebbles and found widespread along the Saon valley and to the characteristic assemblage of which De Terra has given the name Saon Industry.

Paterson has himself given recently (*Nature* 146 (1940) Nos. 3688–9) a summary account of the wider implications of these discoveries in India. He rightly points out that archaeological nomenclature is rapidly approaching a state of hopeless confusion, and at the same time proposes a simple classification of the world's Pleistocene deposits into three cycles—Lower, Middle, and Upper. Paterson is able to fit the Indian evidence into the simple scheme of glacial chronology drawn up by James Geikie, whose work he regards as fundamentally sound and unjustly overlooked. Paterson's attempt to group human artifacts into two great families, the Acheul and Clacton, the latter comprising a number of genera, is less convincing. He makes the Saon culture a genus of the Clacton family, and thus attempts to state its relationship whilst overcoming the difficulty that time and type have been confused in the naming of artifacts.

L. D. S.

BALTORO: ein Himalaya–Buch. By GÜNTER OSKAR DYHRENFURTH, with contributions by HETTIE DYHRENFURTH, HANS ERTL, and ANDRÉ ROCH. *Basel: Benno Schwabe and Co.*, 1939. 10×7 *inches;* 194 *pages and* 140 *pages plates at end; maps and panoramas in separate case. Swiss Fr.*18

This book deals with Dr. Dyhrenfurth's expedition to the Karakoram in 1934. The text is divided into two parts, the first technical and orographical, the second descriptive. All the illustrations form a third and final portion of the book. There is much to be said for this arrangement, which clears the ground by a full historical and topographical summary for a narrative which comes from four hands. Despite the variety of outlook and style to be found among the four contributors, the book forms a coherent account of an expedition on which the difficulties inherent in high-altitude mountaineering were rendered more serious by financial crises and by the presence of a film-making group, whose interests were alien and often opposed to those of the explorers. In the result, the expedition was gravely hampered by the conflicting claims of travel and photography, and it is only when the film group have vanished from the glaciers into Lesser Tibet that the mountaineers enter fully into their kingdom.

The chief aim of the expedition was to climb the peak named as "Hidden Peak" by Conway, and Dr. Dyhrenfurth adopts Conway's unofficial nomenclature for almost all the peaks. An attempt to force a way to the high snow plateau beneath this peak of more than 8000 metres, by a steep rock rib, was frustrated by the refusal of porters to venture on this prepared route: a refusal which can be understood in view of the difficulties met by the French expedition of a later date. Consequently, the party attempted the approach by the "Conway Saddle" and Sia Kangri or "Queen Mary Peak." They reached the summit of this peak, Frau Dyhrenfurth thus creating a new height record for her sex, but further progress was beyond their resources.

Interesting as the text is, the illustrations are of even greater interest and excellence. Some come from Cav. Vittorio Sella, whose portrait with those of other forerunners are given at the outset; the remainder are well up to the high standard set by this early master of mountain photography. H. E. G. T.

AGRARIAN CHINA: selected source materials from Chinese authors. Introduction by R. H. TAWNEY. (International Research Series, Institute of Pacific Relations.) *London: George Allen and Unwin*, 1939. 9×6 *inches;* xviii +258 *pages.* 10*s* 6*d*

Most western scholars familiar with the Chinese language have devoted their attention to ancient history and culture, and the writings of Chinese students of contemporary Chinese sociology and economics remain a closed book to their European and American colleagues. The research staff of the Secretariat of the Institute of Pacific Relations has selected and translated fifty-five articles, some previously unpublished but mostly from Chinese journals, which fall roughly into four groups. The first twelve articles deal with land ownership and distribution, the next twenty with farm economics, fourteen are concerned with marketing and finance, and the last nine with peasant industries. It is to be presumed that the selection has been made on the basis of quality alone: no particular point of view is represented, and there is indeed considerable contradiction between one article and another.

While no geographer needs to be reminded of the complexity and variety of natural environments to be found within the million and a half square miles of China proper, excluding Manchuria, there is a marked tendency amongst economists and others to speak of the country as a homogeneous whole. Many of the apparent contradictions in this collection of writings fade away if the

areas discussed are regarded as units, in many cases with a background and problems peculiarly their own or relating to certain sections of the country only.

Chinese students are sometimes accused of mastering the study of contemporary problems of foreign lands while neglecting those of their own country. This may be due in part to the complexity and novelty of the conditions in their home area, and if there is any one who thinks of China as a country of peasant proprietors whose only concern is to wrest a living from the land this book should dispel such illusions. In many areas the old-time communism of clan ownership gave place to family ownership, then to a division amongst individuals which in turn led to sale of land and its acquisition by a new landlord-moneylender class, the revolt against which and a tendency towards state communism almost completes a circle, with the unstable final result a pale reflection of the old regime. In different parts of China almost every stage in the cycle may still be found, with the superimposed complication of the feudal lord, the official, and the modern war lord. Again and again the impossibility of a direct application of western ideas of "improvement" are emphasized: in a country where almost the only superabundant commodity is human labour any improvement which even tends to economize labour seems doomed only to deepen the poverty it is intended to alleviate. This is a book deserving of careful study, but one from which quotation without relation to context is unusually dangerous.

L. D. S.

JOURNEY INTO CHINA. By VIOLET CRESSY-MARCKS. *London: Hodder and Stoughton*, 1940. 9×6 *inches; 324 pages; illustrations and maps.* 21*s*

In 1938 Mrs. Cressy-Marcks had tabulated the aims of her journey under these headings: "1. From Burma into China *via* Yünnan Province. 2. Szechwan Province, Chengtu, Chunking, and Kuan-Hsin. 3. To study the war and Japan's chances of crushing China; studying the Communists in their own territory in Shensi Province, visiting the new Red Capital and talking to Mao Tse-tung. 4. Through Kansu Province and Tsinghai Province to Koko Nor Lake taking cinematograph films of Tibetans and lamaseries." It was an ambitious programme, but she is an experienced traveller in China and elsewhere, and her enjoyment, courage, and perseverance carried her through the dangers and difficulties she encountered on her 'Journey into China.' She describes how these aims were fulfilled, her transport including pack animals, lorries, local buses, aeroplanes, Chinese carts, and trains.

To the real traveller the travel itself is as valuable as the riches of the destination. For many readers the main attraction of Mrs. Cressy-Marck's book will be in accompanying her on her exacting trail, and sharing her appreciation of moving "among human actions, uncomplicated and reasonable. It is the opposite of so-called civilization, where it is the trail that is monotonous and certain, and the actions of humans that are unknown, and have chaotic results for which we have man-made laws." With a woman's acute observation of detail, she gives a rich tapestry of sane and humble lives under the widely varying geographical and climatic conditions of her route.

For those more interested in her destinations she has much information. Foremost in topical interest stands her account of Red China, and its leader, Mao Tse-tung. The organization, discipline, and high morale, built on great faith in an ideal, and nurtured by education, is remarkable in itself; that it should be the achievement of four-thousand-year-old, "unchanging" China supplies a further justification for those who have faith in the vitality and future of the Chinese people. Of their more immediate fate in the Japanese War, Mrs. Cressy-Marcks believes that the size and geography of the country and the

qualities of the Chinese give China a good chance of victory. Particular interest attaches to the account of the north-west "back doors" of China, over whose roads, which are rapidly being improved, strings of lorries bring war supplies from Russia.

'Journey into China' would have been improved by more revision and the elimination of repetitions, particularly in the historical surveys; but doubtless the author was anxious to give her information expeditiously, and the prompt appearance of her book adds to its value as an aid towards the understanding of China's present problems.

There are many good photographs, an index, and maps. A. M.

BURMA ROAD. By NICOL SMITH. *London: Victor Gollancz*, 1940. 9×5½ *inches; 320 pages; illustrations and end-paper sketch-map.* 16*s*

Mr. Nicol Smith tells the story of a rapid journey through French Indo-China to K'un Ming, the capital of Yunnan province, and thence by car along the newly completed Burma Road to Lashio and back. His style is brisk and popular, and his account interspersed with stories current on the China coast, which he tells with relish. The difficulties of reaching the road are perhaps somewhat stressed, but the inconveniences of travelling over it in the wet season are faithfully recorded. Mr. Nicol Smith was unhappy in his choice of the season, though his journey serves to demonstrate that the road can be used in the rains.

The author has a ready gift for describing personalities encountered on his travels, but a journey by car in the rainy season afforded him few opportunities of learning much about the country through which he passed. Yunnan is not an easy country in any sense, and the peculiarities of its topography and the complicated distribution of the tribes which inhabit it are certain to mislead the traveller who has little time to spare. There are inevitably some inaccuracies. For example (p. 253) Pao Shan is not a "village," but the largest town between K'un Ming and Lashio, and both the caravan road and the motor road pass through it. The Third Month Fair is not held at Hsia Kuan, but at Ta Li (p. 247) and the population of Hsia Kuan, a much smaller place than Ta Li, is not thirty thousand but nearer ten thousand. C. P. F.

AFRICA

A HISTORY OF THE GAMBIA. By J. M. GRAY. *Cambridge: University Press*, 1940. 9½×6½ *inches;* x+508 *pages; map.* 30*s*

Mr. Justice Gray's work has all the virtues commonly demanded of its type, and he adds to them a conscientious but imaginative use of his materials, which not only discovers his own enthusiasm but informs the book with an interest extrinsic to its subject.

Just far enough from Europe to have its beginnings in the pre-history of colonization and developed at a pace and in a manner which permit of ordered and coherent review, the Gambia is well documented from the days of high romance to the days of Blue Books. If there is any deficiency in the written authorities it is perhaps the absence of any collection of family papers such as those which give so vivid a picture of life in Mauritius during Sir Lowry Cole's governorship.

This is essentially a history for geographers. Until he has the author's clearly drawn map in his head, the reader will be unable to progress far at a time through the book without recourse to it; and the Gambia furnishes an excellent

example of the influence exerted by geographical factors over human enterprise. Ethnography however is expressly excluded from the field of the author's primary interests.

The index is barely adequate; and the author's scrupulous citation of his authorities emphasizes rather than excuses the absence of a bibliography.

L. C. H.

SOME LETTERS FROM LIVINGSTONE, 1840–72. Edited by DAVID CHAMBERLIN. *Cambridge: University Press*, 1940. 9×5½ *inches;* xxviii+280 *pages; illustrations and sketch-map.* 12*s* 6*d*

The period covered by these letters corresponds pretty closely to that of the 'Missionary travels,' for though one letter from as late as 1872 is included, the rest belong almost entirely to the first half of Livingstone's career, before he passed from the status of a missionary in the ordinary sense to become the greatest of all pioneers into the unknown interior. Presented in the form of letters, the story is perforce somewhat disjointed and not always easy to follow, and is largely told in more consecutive and readable form in the 'Travels.' A large proportion of the letters were written to representatives of the London Missionary Society and deal with its inner working and routine labours in the field. There is a good deal of outspoken criticism of government action in certain directions, as well as comments, generally good tempered, on inconsistencies or mistakes of superiors or colleagues in the narrower field of the Missions. They were of course made with no thought of publication, and some, one feels, might well have been consigned to oblivion. On the other hand the first-hand picture of the state of the country in those days is of value, and there are interesting notes on its physical character and the various races inhabiting it, though these do not add greatly to what is to be learnt from the 'Travels.' As to the writer himself, the letters bring out once more his dauntless spirit, ready to suffer any hardships in response to the call of duty, his intense sympathy with the African native, and above all an early manifestation of the constant urge to go forward which dominated the second half of Livingstone's African career.

Apart from certain omissions to avoid repetition, the letters are given in their original form, even to the quaint aberrations in spelling and punctuation. The editor has added a few explanatory notes, which might have been extended. One point that may be new to some readers is that before 1855 Livingstone never used the final *e* in signing his name.

E. H.

SAHARA UNVEILED: a great story of French colonial conquest. By PATRICK TURNBULL. *London: Hurst and Blackett*, 1940. 8½×5½ *inches;* 264 *pages; illustrations.* 16*s*

The title of this book is pretentious, for Mr. Turnbull could scarcely have hoped to "unveil" the Sahara, were this still possible, as a result of his travels by car, train, and desert bus in the Southern Territory of Algeria last year. His travels covered the route from Algiers *via* Ghardaia to El Golea, whence he returned by way of Ouargla and Biskra. Although he found in parts of the desert traversed "the nothingness that is yet a fascination" and enjoyed at times being remote from "that jungle which is called Europe," he clearly suffered many discomforts on his journey—the bitter cold of the Atlas in March, flies, stench, and dirty hotels. The book is made up of graphic accounts of places visited, of people met and of native tribes, especially the Touaregs. We are told, too, of the pioneer efforts of the French to conquer, open up, and pacify the Algerian Sahara. The interest to be derived from the book lies in its author's

trenchant descriptions of his impressions, his debunking of Saharan romanticism, and his appreciation of French achievement. Mr. Turnbull was obviously moved by the charm and loveliness of El Golea, and his picture of this "northern outpost of Black Africa" is ably drawn. There are many excellent photographs and some good stories. The map provided is sparing of names, lacks scale, and assigns the Libyan oasis of Ghat to Algeria. René Caillé should be René Caillié. W. G. E.

NORTH AMERICA

SOIL CONSERVATION. By HUGH HAMMOND BENNETT. *London: McGraw-Hill Publishing Co.*, 1939. 9×6 *inches;* xviii+994 *pages; sketch-maps and diagrams.* 40*s*

This volume of nearly a thousand pages, produced in the lavish style typical of modern American text-books, may be regarded primarily as an encyclopaedia of the remarkable series of investigations and projects carried out by the Soil Conservation Service. This service, initiated with a grant of $5,000,000 in September 1933 as a section of the Department of the Interior under the National Industrial Recovery Act, immediately established demonstration works in many problem areas throughout the United States. Within five years the questions of soil erosion and soil conservation, from being the personal worry of the farmer and almost unknown to the townsman had become matters of major national policy, and the present work is invaluable in gathering together not only a comprehensive statement of the problems involved but also a full account of remedial measures and their efficiency.

Chapter ii, entitled Erosion and Civilization and chapter xli, entitled Erosion Problems in Foreign Countries, occupy some eighty pages and deal briefly but clearly with countries other than the United States, while practically the whole of the remainder of the book is devoted to the latter. There is not therefore undue overlap with Jacks and Whyte's "Rape of the Earth" (see *Geogr. J.*, October 1939).

Apart from a casual reference to his thirty-six years of work studying land problems, the author leaves the reader to guess the very large share he has had in initiating and controlling the experiments he describes, and one wonders how he found the time and opportunity to prepare this volume. Perhaps its principal defect is thereby explained; it is rather as if the chapters had been written at different times and afterwards strung together, so that there is a good deal of repetition and a lack of correlation and sequence. Such a fundamental consideration as that of climate appears late and is imperfectly related to the whole; so is the consideration of what the author calls geological erosion. There has been a marked tendency for students of soil erosion to ignore the volume of work which has been carried out on the processes of rock weathering and geological erosion. The author is partly aware of this: but refuses to regard man as a geological agent and claims geological erosion as applicable primarily to the desert areas of the world. There is a tacit assumption that elsewhere soil formation, unless interfered with by man, should balance soil erosion. How far this is true of such climatic regions as the Mediterranean where soil forms slowly under conditions of a humid cool season and a dry hot season is a doubtful point. It is indisputable that man's activities normally accentuate erosion: what is required is not the prevention of erosion but its limitation to a "normal" amount. Since man by ploughing, manuring, and cropping is by far the most

potent soil-forming agent to-day, it is not sufficient to take ungrazed pasture or untouched forest as the "controls" in experimental comparisons.

It is clear that the most effective means of soil conservation is the maintenance of a continuous grass sward, from which soil loss can be virtually nil. Any form of ploughing induces some loss. The relative freedom of Britain from soil erosion is perhaps due not so much to climatic conditions as to the traditional grassland farming. There is a real element of danger here in the plough-up policy—slight if the small British fields are maintained but increasingly real if attempts are made to develop large field units on sloping ground.

In at least two other ways this book has important lessons for Britain at the present moment. The valuable experiments described were initiated when America was in the depths of the Great Depression: they were carried out largely by young University graduates who would have been unemployed had not the Government realized the importance of setting them to constructive work. In the second place the whole country was divided into "Problem Areas" which coincide closely with the natural regions of the geographer and ignore state boundaries. Thus it is recognized that the Atlantic Coastal Plains, the Southern Appalachians, New England, the Prairies, the Great Plains, and the other regions each have their own sets of problems. Because Britain is a small area, there has been and still is a failure to recognize the fundamental contrasts between its very varied regions. Land and agricultural problems must be studied regionally, yet the official "agricultural regions" of England and Wales (see *Geogr. J.*, July 1939; Gilbert's paper) are probably about the most absurdly artificial divisions ever used in this country. L. D. S.

ARCTIC LIGHTS. By DESMOND HOLDRIDGE. *London: Robert Hale*, 1940. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 240 pages; illustrations.* 10*s* 6*d*

Stimulated by a favourable reference to his work in the reports of the Alexander Forbes surveying expedition to northern Labrador, Mr. Holdridge has added to his travel books by writing this fifteen-year-old recollection of his voyage along the coasts of Nova Scotia and Labrador in the 30-foot schooner *Dolphin*. He had only two companions, and very little money to buy essential stores; but in face of great difficulties they managed to sail the boat as far as the Hudson Strait, and did not lose her till they reached Newfoundland on the homeward run. The book does not offer new information, but it gives a good idea of the difficulties of small-boat sailing in these northern waters and a graphic picture of the stark ruggedness of the Labrador coast. There are also interesting notes on the water-side dwellers, traders, fishermen, and Eskimos.

The only new country seen by Mr. Holdridge and his companions was the mountainous land-locked Joksut Fjord; but they were not able to explore it, being storm bound for five days and finally cast ashore. From one of the neighbouring heights they were amazed to see the ocean outside lying smooth under a light offshore wind while the surface of the fjord was still whipped by furious squalls. They managed at great risk to get their boat off, and outside they had to set all sail to make her move. The weather conditions along the Labrador coast in July were not severe, but at the end of August and early September gales were frequent. By the time they reached Newfoundland the *Dolphin* was unseaworthy, and they finally had to hoist a distress signal and were picked up in a sinking condition by a cod-fishing schooner. They were without a motor for most of the voyage, having been forced to sell it to buy food and stores.

The book would be much more readable if it had a sketch-map.

G. E. R. D.

CENTRAL AND SOUTH AMERICA

GUATEMALA PAST AND PRESENT. By CHESTER LLOYD JONES. *Minneapolis: Univ. of Minnesota Press*, 1940. 9×6 *inches;* xii+420 *pages; illustrations and sketch-map.* $5

Partly for political reasons, and partly because of the difficulty experienced since 1936 in maintaining contact with Spain, the study of Spanish in the United States is becoming increasingly directed towards Hispano-America, and the pioneer work done for many years past at Harvard, Yale, and Stanford Universities is being widely extended all over the country. The foundation, in 1939, of the Instituto Internacional de Literatura Americana, with its review, *Revista Iberoamericana* and its biennial congress, assures the movement a broad basis and a continuity which should encourage individuals to engage in long-term schemes of study and research and to produce substantial works of lasting value.

Such a work is Professor Lloyd Jones' book on Guatemala. Full, comprehensive, attractively written and illustrated, yet generously documented, it meets the needs both of the general reader and of the scholar, and, as more American capital is invested in Guatemala than in any other of the Central American republics, it may be expected to be widely read in the United States.

The threefold aim of the book is to study the history and political development of Guatemala, its economic advance in recent years, and its social life and problems. Besides consulting Guatemalan and foreign works, enumerated in an excellent bibliography, Professor Lloyd Jones has paid four visits to the Republic, and his treatment of its peculiar problems shows sympathy and tolerance as well as knowledge. This is particularly marked in the chapters on constitutional and popular government and in the pages on religion. The theme of democracy *versus* dictatorship is no easy one to treat when it is necessary to describe and interpret conditions so dissimilar from those within one's readers' experience. Here is a country in which, for more than four centuries, races and cultures have been in conflict and popular control has made no consistent advance. So-called republican rule has demanded strong governments, and, though these have amounted to dictatorships, they have been accepted even by Liberals as the only alternative to anarchy. Some progress is apparently being made towards terminating this type of dictator rule, and is welcomed even by the authoritarians in power, but it seems unlikely that the end will be achieved save after a long struggle and many setbacks. If the reader is to appreciate a situation which involves such paradoxical elements, the expositor needs skill, resource, and imagination. Still more are these called into play in the description of religious belief and practice in a country where "all but a very minor fraction of the people . . . are nominally Catholics," but in many parts of which religious observances "shade off into a wide range of ceremonies and beliefs, some indicating preconquest origin and distinctly non-Christian character." The ubiquity of this phase of Guatemalan life is evident from the frequency with which the author returns to it. His touch is everywhere sure and his objectivity admirable; he avoids both excessive idealism and hasty judgment, and fully recognizes that there are other views on the subject than his own. E. A. P.

PRE-HISTORY IN HAITI: a study in method. By IRVING ROUSE. (Yale University Publications in Anthropology, 21.) *New Haven: Yale University Press* (*London: H. Milford*), 1939. 9½×7 *inches;* 202 *pages; illustrations.* 15*s* 6*d*

The material for this paper, the sub-title of which proclaims it "A study in method," was excavated by the author, Dr. Irving Rouse, and by Dr. Froelich R.

Rainey, from a number of middens in the Fort Liberté region of Haiti during three months of 1935. The definitive report of the excavations being as yet unpublished, interest will centre on the theoretical part of Dr. Rouse's paper, in which he presents and develops what he terms "a new conceptual approach to the problem of historical reconstruction from archaeological specimens."

On general grounds any such attempt is welcome; for archaeologists have been too prone to engross themselves in collecting and classifying specimens, while largely ignoring the ultimate aim of their inquiries. Now there are signs that archaeology is passing from the pioneering-acquisitive stage to one in which philosophical reflection is appreciated, if only to give direction in assembling further facts.

Unfortunately Dr. Rouse's performance does not match his intentions. It is rare to find notions so elementary expressed in language so portentous. Take his "three sets of working concepts." He would restrict the use of the first concept, "type," to "standard of appearance." Technique of manufacture, designs, and material specifications, he would include in his second concept "mode." We may concede that "type" has been used loosely, without admitting that archaeologists disregard technique or those other attributes which most people refer to by name, but which Dr. Rouse wishes to disguise under his omnibus term "modes." His third "new" concept is the "time scale." In default of an exact chronology some form of arbitrary time scale has been so generally conceded a prime necessity, that the main body of archaeological research in the Old World has, since the time of Montelius, been concentrated precisely on the construction and perfection of such. The conception of a "time scale," indeed, may be said to be part of the basic grammar of archaeological teaching.

Dr. Rouse has also five postulates. To his first, "Culture does not consist of artifacts," he devotes three pages. The essence of the matter is:

"The behaviour which people perform in reference to artifacts is of at least two different kinds, that concerned with the manufacture of the artifacts and that associated with their use. Depending upon which kind is discussed, the artifacts can be considered either as the end point of a process of manufacture, *i.e.* as the result of certain culturally conditioned behaviour, or as objects used in certain situations, *i.e.* as the means for culturally conditioned behaviour. In this discussion, they will be considered in the former sense rather than in the latter. . . .

"For purposes of this study, then, the artifacts have to be the results of the artisans in making them. This relationship may be expressed as follows:

Artisan's Procedure (or Behavior)
↓
Artifacts. "

As an exercise in the art of spinning words round an idea which does not require statement these pages have a quite singular merit. J. G. D. C.

THE GREAT NATURALISTS EXPLORE SOUTH AMERICA. By PAUL RUSSEL CUTRIGHT. *New York: Macmillan and Co.*, 1940. 9½×6 *inches;* xii+340 *pages; illustrations and end-paper maps.* 12*s* 6*d*

This is a great subject of which the author has not made the most. The lives and travels of the naturalists are accounted for in a short introductory chapter, the effect of which in presenting to the reader the natural features of the continent is weakened by the absence of detailed maps and of that personal touch which only first-hand experience can give. The remaining chapters summarize, with additions, the travellers' accounts of the most noteworthy animals. These, the

mammals especially, are so curious and delightful, that his review contains much of interest. The illustrations, chiefly of animals photographed in captivity, are numerous, but their value is diminished by their not being numbered and consequently never referred to in the text. The writing is full of romantic circumlocutions and ponderous pseudo-scientific phrases, among which excerpts from earlier authors stand out with welcome freshness. If the reader is persuaded to read these classics for himself this book will have done a great service. The index is very full. G. I. C.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

LIFE ON OTHER WORLDS. By H. Spencer Jones. *London: English Universities Press*, 1940. $7\frac{1}{2} \times 5$ *inches;* xiv+260 *pages; illustrations.* 5*s*

The interest of this book is wider than its title suggests, for the first hundred pages are given to a masterly summary of the physics and chemistry of our own world as an abode of life: the atomic theory of the elements, the delicate structure of carbon compounds, the range of temperatures within which life is possible, and the way in which living matter derives energy from oxidization and fermentation. A sketch of the kinetic theory of gases and the velocity of escape from planetary atmospheres leads to the history of our own, the early loss of hydrogen and helium, the abstraction of carbon from carbon dioxide by vegetation, and its preservation from decay in the coal and oil deposits, leaving free oxygen in the air to support us, but only so long as the coal and oil remain for the most part unburned. A planet much smaller than the Earth will have little atmosphere: one much larger a poisonous atmosphere of marsh gas and ammonia; or if as far from the sun as Jupiter the ammonia may be dissolved in a thick covering of ice over the rocky core, and the pressure at the base of the atmosphere be sufficient to liquefy its gases. An atmosphere which will support anything like our own life is therefore the result of a very delicate balance of conditions, which must be rarely achieved. Moreover, if the distribution of the stars has not greatly changed since the past, it is almost certainly proved that anything like our solar system of planets is exceptional: few stars can have one. Only if we accept a certain implication of the Expanding Universe theory can we escape this conclusion, and the Astronomer Royal seems prepared to accept it. He supports his Preface with two quotations from de Fontenelle: may we suggest here a third, on the mathematician who "leads you so far (whether you will or no) you have much ado to believe him."

Only on one small point are we entitled to differ from the Astronomer Royal. He says on p. 4 that the method of determining the distance of the nearer stars is "essentially the same as that employed by the surveyor to measure distances on the Earth's surface." Surely there is an essential difference, the astronomer's measures being relative to a distant background, the surveyor's absolute.

A. R. H.

LIGHT AND COLOUR IN THE OPEN AIR. By M. Minnaert. *London: G. Bell*, 1940. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xii+362 *pages; illustrations and diagrams.* 15*s*

Professor Minnaert's work is not specifically on meteorological optics proper, but embraces the wider subject of landscape optics and so covers quite a new field. The treatment is thus largely physical and mathematical, but the spirit of the book may be judged from the following passage in the preface: "It is indeed wrong to think that the poetry of Nature's moods in all their infinite variety is lost on one who observes them scientifically, for the habit of observation refines

our sense of beauty, and adds a brighter hue to the richly coloured background against which each separate fact is outlined."

In the thirteen chapters the various optical phenomena of the open air are explained by the laws of reflection, refraction, and diffraction of light, and there are thorough accounts of mirages, the green flash at sunset, the scintillation of stars, rainbows, haloes, and coronae. There is a chapter on the judgment of shape and motion which includes the explanation of the apparent flattening of the sky, and one on after-image and contrast phenomena wherein a number of striking illusions are demonstrated. It is shown for example that a grey sky which looks so much duller is actually brighter than the snow-clad ground beneath it. The inter-acting colours of land, sea, and sky are dealt with in later chapters. It seems rather a sweeping generalization to say that the "proper" or "self" colour of the sea is olive green north of 40° N., indigo between 40° and 30° N., and ultramarine south of 30° N. The description of the multitude of twilight effects including the zodiacal light, counter glow, purple and second purple light, earthshadow, etc., says much for the author's experience and powers of observation, though it may prove a little bewildering to the reader, who will wonder whether it is possible to disentangle and identify all these sky glows.

A table on p. 301, showing a colour-scale for various stars and planets, ranging from −2 blue to +9 red, is most confusing. In it there appear independent numerical estimates from "skilled observers" who however are stated to be unable to see blue as such. Thus Sirius, which to many people flashes so splendidly blue on winter evenings, is given a value 0·8, that is white or yellowish-white.

The fact that the midnight sky in moonlight is often strikingly blue has of recent years been discussed in meteorological literature; but it is a misjudgment of the case to ascribe the effect largely to our orange-coloured artificial light. The author may not in Holland have observed the effect away from the influence of artificial light; but the reviewer in England has repeatedly tested it not only in remote country districts but also in the suburbs of London in black-out conditions, and has found the blueness of the midnight sky as striking as ever. In fact the very glaring artificial light in the centre of cities simply extinguishes the sky altogether, turning it black.

In so comprehensive a work on light and colour in the open air it is strange that no reference should be made to another phenomenon discussed in recent years in meteorological literature, namely the apparent globularity of the white daylight moon in opposition to the flatness of the yellow night moon. This is an acknowledged fact of scenery, although it has been shown that it is impossible for the eye to distinguish objectively the curvature of the lunar disc. Whatever may prove to be the correct scientific explanation in terms of differential illumination, the case exemplifies the aid which the landscapist and artist can render in the elucidation of physical problems merely by insisting upon the scenic facts observed in the open air.

The book, translated from the Dutch, is well illustrated. L. C. W. B.

ADAPTIVE COLORATION IN ANIMALS. By HUGH B. COTT. *London: Methuen*, 1940. 10×7 *inches;* xxxii+508 *pages.* 40*s*

In this large and well-illustrated volume the author discusses at length reason or reasons for the various colour patterns found in the animal kingdom. This is a subject which has attracted the attention of many naturalists especially during the present century, due to the stimulus aroused by the work of Sir E. Poulton, who has made this matter his favourite study for many years.

Mr. Cott, who is now a Lecturer in Zoology at Cambridge, has travelled

widely in the tropics of both the Old and the New World, and has contributed many observations at first hand, and these he has combined in a comprehensive review of the whole subject. He has presented us with a vast number of facts and observations which are somewhat difficult to analyse.

One of the chief objections to the explanations of so many of the observations brought forward is that everything is interpreted through the human sense of vision, and it seems difficult to prove that the eyes, for instance, of insects which are constructed on entirely different principles to those of man or mammals, produce the same visual impressions. This important fact is not even discussed by most writers on animal coloration.

Mr. Cott divides adaptive coloration into three principal categories: concealment, advertisement, and disguise. In the first category are the various ways in which animals resemble their surroundings. The simplest are perhaps the white colour of many of the inhabitants of high mountains or the arctic regions, or the sandy shades assumed by most desert animals—mammals, birds, and insects. More elaborate and less easy to interpret are obliterative shading and disruptive coloration. It is this last method of concealment which is generally known as camouflage, where the coloration is broken up and the patterns tend to distract the eye from the general shape of the object. This is discussed at considerable length by Mr. Cott and many remarkable instances of it are considered in detail.

The second category of adaptive coloration is termed advertisement. In this a conspicuousness is assumed to warn others away from meddling with creatures protected either by their nauseous taste, their unpleasant secretions, or the possession of poison fangs or stings. The best-known instance of the first of these are the Heliconid Butterflies, all of which are avoided by birds and other butterfly eaters. A good example of the second is the Skunk, which is most conspicuously coloured in black and white in advertisement of its power of ejecting its horrible smelling fluid from the anal glands. In the third group many fishes as well as the familiar bees and wasps warn their potential enemies of the danger of meddling with them by their conspicuous coloration.

But perhaps the most wonderful instances of protective coloration are those to which the term mimicry has been applied. It is of special interest to Fellows of this Society that the first observations and the explanation of this phenomenon were made by Mr. H. W. Bates in the Amazon valley before he became Secretary of the Society. Mr. Bates observed that certain of the Heliconid butterflies, already alluded to as protected by a nauseous taste from the attacks of birds, occur in large numbers and are conspicuous and slow flying. These are accompanied by certain other butterflies of quite different families which have apparently acquired the livery of the Heliconids and so escape attack. Since Bates's time a large number of instances of similar imitation have been found in tropical Africa and elsewhere.

Although some of the explanations of adaptive coloration have been perhaps forced, there can be no doubt to any reasonable mind that most of these resemblances, found almost universally among living creatures, are the result of what Darwin termed Natural Selection, and that this has played a most important part in evolution. Though now it is usual among the modern school of biologists to reject the influence of Natural Selection in evolution, the facts of adaptive coloration as given in Mr. Cott's work are a strong argument in its favour, and must be given due weight. This is what Mr. Cott claims to have accomplished in a volume which will certainly take its place as a most valuable contribution to zoological literature. W. L. S.

THE MONTHLY RECORD

THE UNITED STATES ANTARCTIC SERVICE

The press cuttings of the Scott Polar Research Institute, which we have been allowed to see, do not add much to the news from the two stations in the Antarctic of which we gave a brief account in the *Journal* for June last, p. 476. A despatch from the western base near Little America, published in Washington on March 12, reported a flight of February 29 across the Ross Barrier to the Beardmore Glacier: thence to a point 84° 10′ S., 150° W., and so back to the base. This was considered the very last long flight that could be made with reasonable safety before the Antarctic winter. On March 9 however the machine belonging to the Snow Cruiser unit made an ascent to over 21,000 feet to measure cosmic rays. Up to May 25, the date of the last cutting from the *New York Times* received at Cambridge, there was no more news from the eastern base in Marguerite Bay. Meanwhile Admiral Byrd arrived in New York on May 14 on his return from the eastern base, and the *Christian Science Monitor* of May 20 reports him as saying that although he believed the chief value of the discoveries in the Antarctic to be scientific, "in the event of a war, and if anything happened to the Panama Canal, the United States might be glad to have this newly claimed region as a possible base for ships."

The Evening Standard of July 6 published a despatch from Washington to the effect that the President had signed a bill providing the money to bring the expedition back to the United States, but nothing to permit the continuance of their work for another season. The same despatch quoted Mr. Cordell Hull, Secretary of State, as saying that the expedition was essential to the task of getting a clearer title to the Antarctic regions claimed by the twenty-one American Republics. We do not remember to have seen before so serious a suggestion of claiming title in the Antarctic by operating from bases in British territory.

The Engineer for 3 May 1940 contained a long and well-illustrated account of the Snow Cruiser constructed at a cost of 150,000 dollars by the Research Foundation of the Armour Institute, Chicago, and placed at the disposal of the United States Government, which is to defray its cost of operation and maintenance and return to the Foundation. An abstract of this paper will be published in the *Polar Record*.

THE HIMALAYAN JOURNAL, VOL. XII, 1940

The twelfth volume of the *Himalayan Journal* maintains its high standard of climbing narrative, and has papers of exceptional interest to geographers. Messrs. F. Ludlow and George Sherriff had planned for 1938 a second expedition to the region of the Tsangpo gorges and Dr. G. Taylor of the Department of Botany, N.H.M., was to have gone with them, but was delayed by illness. Messrs. Ludlow and Sherriff started from Kalimpong on February 22, thence by Phari and Gyantse to the Tsangpo, leaving instructions for Dr. Taylor to join them at Molo in Kongbo province of which he had never heard. They reached Molo on May 17, and Dr. Taylor arrived from England half an hour later: "Tibet is not so strictly *purdah* as she used to be." A useful sketch-map shows many passes on the almost unknown main Himalayan range between 93½° and 96° E.—including the Tum La, 12,000 feet (the lowest known pass across the range except for the Zoji La in Kashmir), the Tunga La (which a footnote says does not exist), and the Shoka La (reputed lower than the Tum La). The first interests of the expedition were flowers and birds; the photographs and description of new country give the paper a wider importance.

Mr. Auden s account of a season's work (January–July 1939) in the Central Himalaya, based upon new Survey of India maps between Bandarpunch and Kamet peaks, has a valuable appendix on Supplies. The Editor's request for continued observation of the Shyok glaciers has produced more figures which justify his predictions for 1935 (*Geogr. J.* 85, 24–41) and embolden him to make others for 1970 and 2005. Another useful piece of geography is the account by N. E. Odell and Peter Lloyd of the Chorten Nyima La which they crossed in 1938 on their way home from the last Mount Everest Expedition.

There are papers on the ascent of Dunagiri, Gauri Parbat, and other peaks by a Swiss expedition; of Nanda Devi East by a Polish, and an attempt on K2 by an American expedition. All three involved serious casualties: two porters of the Swiss party, two climbers of the Polish, one climber and three porters of the American. The Editor deals severely with these accidents and gives on p. 128 a graphic exposure of the dispositions on K2.

AGRICULTURAL EXPORTS OF TURKEY

An analysis of Turkish agricultural production and export trade, based upon official statistics, is contributed to *Foreign Agriculture*, April 1940, by Mr. N. W. Hazen. Although Turkey is primarily an agricultural country, 80 per cent. of the population engaging in farming, there is still room for considerable expansion, since one-third only of the estimated arable area is at present under field crops. On this restricted area, yields could also be much higher, though in recent years the state, by technical instruction, free distribution of land, agricultural credits, grading, and encouragement of exports, has done much to increase production. A recent outstanding development has been the transition of Turkey from a wheat-importing to a wheat-exporting country; from the period 1930–32 to 1936–38 the average wheat acreage increased from 6·9 to 8·8 million acres, and in the latter period 3½ million bushels were exported. Wheat is regularly bought by the government at 30–40 per cent. above world prices, and a reserve maintained, amounting at the beginning of this year to 9½ million bushels. Though important for domestic economy, wheat ranks only sixth among Turkish agricultural exports, which together account for about three-quarters of her exports; at the head of the list stands tobacco, representing in value somewhat more than a quarter of all exports. Since 1926 the export of tobacco has declined, though recently this tendency has been checked and exports have risen 50 per cent. In order of value tobacco is followed by shelled filberts, from the eastern Black Sea coast, raisins, cotton, mohair, and figs. With the exception of cotton, Turkey is now the leading world exporter of all these products. The increase of the cotton acreage from 400,000 acres in 1923–25 to 700,000 acres in 1936–38 has also made Turkish industry independent of cotton imports. Quality has been improved by the introduction of American varieties on about one-third of the acreage. The State has also done much to improve the quality of the raisins, having distributed two and a half million American seedlings free in 1936.

Mr. Hazen also describes at length the development of Turkish economic policy since 1930. Previously the balance of trade had always been against the Republic, but since then, by clearing and compensation agreements, the balance has been rendered favourable, with the exception of 1938. Turkish foreign trade policy has been controlled by the circumstance that in the main her exports are the same as those of her immediate neighbours; consequently her chief markets are those of Western Europe and the United States. From 1933 to 1938, the outstanding development was the domination of Germany in the foreign trade (about 45 per cent. of exports and imports in 1936–38),

secured largely at the expense of France and Italy. Recent policy has aimed at the cessation of dependence upon a single market by credit and trading agreements with Britain and France. Relations with the United States are complicated by the fact that though the latter is Turkey's second best customer, taking nearly one-third of the tobacco export, this trade is used as the main source of Turkey's foreign exchange rather than for the purchase of American goods, and that Turkey is also a competitor in the British market in respect to tobacco and raisins. If Turkey is to buy industrial products to any extent in the United States she will require to increase her exports thither.

LAND PROBLEMS IN MICHIGAN

Problems of land use and settlement in Michigan are discussed in a number of articles in the *Papers* of the Michigan Academy of Science, Vol. 25, 1939. These are largely based on the records of land sales for tax delinquency. Miss M. C. Stirling and Mr. K. C. McMurray deal with the general problem. As a result of the 1938 sale, approximately 2 million acres were added to the State domains, doubling their size. These failures were mostly due to repeated attempts to farm the light sandy lands cleared by lumbering. Immigration began in the 'sixties, but by the end of the century, two waves of settlers had failed. To get the land back on the tax-roll at any cost, it was decided in 1901 to abandon the homestead policy, and to sell "any quantity to any buyer." This opportunity was immediately abused by speculators who obtained the land at an average price of 80 cents an acre, stripped it of the remaining timber, and promoted agricultural colonization for a third time, with the inevitable results. The problem was finally tackled by the creation in 1909 of the Public Domain Commission. Tax delinquency at first declined, but from 1920 a severe period set in, owing to the final failure of agriculture to absorb appreciable quantity of wild land and the exhaustion of the hardwood lumber area. The 1938 tax sales suggest that in the pine areas of the Lower Peninsula a balance has now been struck between public and private ownership, that the better farming areas are well established, that the marginal farm areas, mostly in the Lower Peninsula and originally hardwood lands, are declining, and require adjustment of use, and that excessive delinquency has occurred in the Upper Peninsula, probably owing to the abandonment of speculative mineral holdings and the exhaustion of timber resources. Much work is being done by the Department of Conservation in mapping the land types of these areas and in assessing their true value. The policy is to encourage private ownership where the conditions are favourable.

An example of these investigations is given by Mr. G. S. McIntire in his account of land ownership in a township of Ogemaw county, in the north-eastern pine area. Its area is approximately 23,000 acres; by 1880, 17,600 acres had been sold to homesteaders, yet the State now owns 19,180 acres, of which more than 12,000 had once been in farms. The area was generally described by early surveyors as "rolling poor sandy lands" or "fire lands." The railway company in pushing the sale of its land grant in 1875 described them as possessing the same qualities of soil as some of the best lands of England and the United States, and as seeming to lack vegetable matter only. Prices then ranged from $10 to $25 an acre. An excellent crop of wheat is said to have been harvested the first year, but the farmers failed to get their seed back the second year. Employment in nearby lumbering camps enabled them to subsist for a few years, but by 1891, half the farms had been abandoned. In the period 1903–11 over 10,000 acres were sold at an average of 73 cents an acre to speculators, and resold to farmers. One speculator purchased 1760 acres, almost all of which have reverted to the State once more, and some areas have reverted three times.

THE INDUSTRIAL DEVELOPMENT OF THE SWANSEA REGION

In his monograph on the economic development of the Swansea district to 1921 (Social and Economic Survey of Swansea and District, Pamphlet No. 4, University of Wales Press Board, 1940), Mr. D. T. Williams discusses particularly the factors influencing the location of industries. By the fifteenth century the town's favourable position on the coast and its communications with the interior had made it more than a centre for local exchange between agricultural districts, particularly of the Gower peninsula. Foreign vessels from Brittany and the Channel Isles, especially Jersey, were bringing cargoes of salt and wine, and carrying back coal, and Swansea ships were carrying coal to ports in the Bay of Biscay. The annual shipments of coal from Swansea and Neath is estimated to have increased from 2400 tons in the period 1551–60 to 40,000 tons in 1688–90. The establishment of smelting industries, the first of which started at Neath Abbey in 1584, was based upon local coal, Cornish copper which came up the river (navigational difficulties developed later), lead ore from the Cardigan mines, water-power, and charcoal from the neighbouring forests. It was not until 1717 that smelting was begun at Swansea, and six other furnaces followed during that century. The author stresses the important influence of individuals and capital from outside. By the end of the century it was clear that if industrial progress were to continue, improvements to port and river navigation were essential. At first the Corporation, inclined to preserve the town as a health and tourist centre, was opposed, but in 1791 an Act was obtained; the depth of water over the outer bar was increased by the building of two piers, the lower banks of the river improved, and a light set up at Mumbles Head. The completion of the Vale of Neath Canal, the Swansea Valley Canal to Ystradgynlais, and other canals established Swansea as the dominant outlet of the rapidly developing industrial region.

For the nineteenth century, Mr. Williams analyses in detail the history of coal mining, the smelting industries, port development, and maritime trade, and population. He has mapped the collieries and their relative importance at four periods; all classes of coal-mining were at their peak in the first decade of this century, the outstanding development being that of the overseas anthracite market after 1883–85, and particularly the recent growth of the Canadian market which now absorbs about 1 million tons a year. In the copper-smelting industry the prosperous period lasted until about 1890; the establishment of a monopoly however led to the overseas producers preferring to smelt the ore near the mines and to export the metal direct to the manufacturers of Birmingham, Liverpool, and elsewhere, which led to the decline of the Swansea industry. Other smelting industries have also disappeared, and the non-ferrous industries are now represented by works refining and manufacturing copper plates and sheets, lead sheet and pipe manufacturing, a zinc spelter works, and the nickel refining works at Clydach. The rise of the steel and tinplate industry in the coastal belt after 1873, consequent on technical improvements, also reflects the advantages of sea transport for the import of pig iron and scrap and the export of the finished products; plentiful supplies of water and of fuel (about 4 million tons of Welsh coal are used annually) are also elements in the location of this industry.

TWILIGHT: CIVIL, NAUTICAL, AND ASTRONOMICAL

The Nautical Almanac defines twilight as the *periods* evening and morning between the *times* (called astronomical twilight) when the sun is 18° below the the horizon and the times when its refracted upper limb is on the horizon at sunset or sunrise. It then divides these periods each into three by defining civil

twilight as the *time* when the centre of the sun is 6° below the horizon, and nautical twilight as the *time* when it is 12° below. At sunset as above defined the unrefracted centre is then 50′ below the horizon and has to sink only 5° 10′ before the time assigned to civil twilight: so the intervals between the three tabulated phases are not equal. The Nautical Almanac considers that if the sun is much lower than 6° "ordinary outdoor civil occupations are impracticable without artificial light"; that civil twilight (not nautical) or some time near it, indicates the moment when the horizon ceases to be visible in a sextant; and that any given degree of indirect illumination (in the absence of moonlight) will always be associated with the same depression of the sun below the horizon. In all this it must be assumed that the sky is clear. The shortening of effective twilight caused by cloudy skies corresponds roughly to the distinction made by the Road Transport Act 1927 in the times of lighting up: half an hour after sunset when Summer Time is not normally in force, an hour when it is.

These rules take no account of the light of the night sky. On a bright starlit but moonless night one can see the main features of the landscape after a few minutes away from artificial light; and part of the light comes from permanent auroral glow.

In latitude 50° civil twilight lasts for 32 minutes at the equinoxes, 44 minutes at the summer solstice, and 38 minutes at the winter; in latitude 60° the durations are 43, 116, and 57 minutes. At the equator they are about 22 minutes at all seasons, and one may inquire why, according to the poet, and in general repute, there is no twilight in the tropics. "The Sun's rim dips, the stars rush out: at one stride comes the dark," said the Ancient Mariner. A few lines later he made a celebrated blunder about the moon, and was certainly no astronomer: but he expressed in defiance of arithmetic and the Nautical Almanac the view that the so-called civil twilight of 22 minutes instead of a few minutes over 30 (at the equinox) makes difference enough to justify the phrase "at one stride." If he was native of Shetland and thinking in the tropics of midsummer at home, the proportion 22 to 116 is more striking: yet hardly justifies the phrase "the stars rush out," at least according to Bravais, who wrote in 1850 from long observation, presumably in Paris, that he found first magnitude stars were not seen, even in the east, until the end of civil twilight defined as above. According again to Bravais, the "Crepuscular Curve or Twilight Bow," that is the border of the earth's shadow cast by the sun, reaches the zenith when the sun is down 6°, *i.e.* at civil twilight; and in clear tropical skies, with little dust in the air to scatter light, this would make the stars "rush out" in the eastern half of the sky as the shadow rises: an effect that we miss in our watery and dusty skies. Otherwise, there must be some psychological reason for the general feeling that there is practically no twilight in the tropics, or that dark comes very suddenly, which is not quite the same thing.

Nautical twilight might have been called naval twilight, for it is supposed to mark the end of the time in which there is or may be just enough light for handling and landing boats; the sea horizon for sextant observations has disappeared earlier, round about the time called civil twilight. But even astronomical twilight is not to be despised: clear nights in June are in our latitudes never really dark.

These questions of twilight have now more importance than usual; Wardens and Home Guards would find it interesting to note each evening the time when it is effectively dark enough to stay or permit certain operations, and so estimate the value and significance of these twilight tables first calculated for the Nautical Almanac for 1937, and summarized in Whitaker.

ADDITIONAL NOTE ON MR. JOERG'S INTERPRETATION OF THE ELLSWORTH PHOTOGRAPHS

On August 19, when the note on the 'Diagram relating the Discoveries . . .' (page 177) had already gone for page proof, we received Proceedings of the American Philosophical Society, Vol. 82, No. 5, containing the papers read at the Centenary Celebration and Symposium on American Polar Exploration held at Philadelphia on 23–24 February 1940. Among them is one by Mr. W. L. G. Joerg, "Demonstration of the Peninsularity of Palmer Land, Antarctica, through Ellsworth's flight of 1935." It has two figures, the first, "Air photographic survey by Ellsworth, Nov. 21 and 23, 1935. Published July 1937," based upon Joerg's Map A; the second, "Ground survey by Rymill expedition, Nov.–Dec. 1936. Published May 1938. As copied on Hydrogr. Office Chart 5411." The first has still no graticule; the second lies between 68° 50′ and 71° S. It is implied that Fig. 1 corresponds with the eastern half of Fig. 2, though on his Map D Joerg has tentatively placed his Map A between 68° 10′ and 69° 35′, a good deal farther north, which we have found very nearly right.

Chart 5411 was produced for the use of the United States Antarctic Service, and by the courtesy of the Hydrographer U.S.N. we had received a copy of it in January last. For Southern Graham Land it follows in general the B.G.L.E. map on 1/3,500,000 published in the *Journal* for May 1938, but to Rymill's unnamed cape in 69° 40′ S. the name Cape Keeler is assigned, and others of Wilkins' names to features west and south down to below 70° S. Moreover, spot heights in metres associated with these names on Joerg's Map A have been converted to feet and annexed to these features of Rymill's map. In his letter of 8 December 1939 accompanying the gift of the chart Captain G. S. Bryan explained that it had to be completed before his department had finished their researches, and that later information might change some of the names.

Now wherever Cape Keeler may be, it is at least north of Cape Mayo, and we have shown that the latter is just north of parallel 69° rather than in 69° 50′ S., as Chart 5411 shows it. It follows that all the names of Wilkins and the spot heights from Map A shown on Chart 5411 and on Joerg's Fig. 2 belong about 50′ farther north; and that Joerg has been mistaken in finding correspondence between his Air Survey from Ellsworth's photographs in his Fig. 1 and the Ground Survey of the B.G.L.E. copied into his Fig. 2. The first lies almost entirely north of the second, as he had shown on his Map D and we have shown on our Diagram.

A note to Figs. 1 and 2 suggests that had Rymill's map been available in 1937 the name Casey Glacier would have been applied in Map A and Fig. 1 to the Major Valley Depression; and that probably Cape Keeler (with Mount Ranck) and Cape Mayo should then have been placed at the north-western and south-eastern portals of Casey Glacier, as Wilkins placed them. We had come independently to a similar conclusion (see p. 180); but it requires that the portals shall be much farther east than they are shown on Map A.

Mr. Joerg suggests that the depression running east from the Wordie Shelf Ice, and lying to the north of Rymill's route to the eastern coast, is Wilkins' Casey Channel; but the latter is now shown to be 50 miles farther north. Only its entrance is shown on Map A; no photograph looks up it, and only E.15 and E.16 across it in cloud from 20 miles away. We do not think it possible to say that Ellsworth's photographs tell us anything of its level. Ellsworth logged it as Stefansson Strait. Kenyon radioed "Looks a channel O.K." Rymill proved that no channel comes out anywhere in that latitude on the west coast. Without that proof we do not think that there is anything like a "demonstration of the peninsularity."

A. R. H.

OBITUARY

DOCTOR ALFRED CORT HADDON, F.R.S.

Doctor Alfred Cort Haddon, who died last April in Cambridge at the age of nearly eighty-five, was educated at Christ's College, Cambridge, and was from 1880 to 1901 Professor of Zoology at the Royal College of Science in Dublin. In 1888 he paid an eight months' visit to the Torres Straits to study coral reefs and marine zoology; it was this visit that changed his future interests and activities. In his spare time he collected information from the islanders of the Straits about their folk-lore, ceremonies, and beliefs, and thus he came to realize the importance of rescuing such fast-perishing knowledge from the older natives in the face of advancing civilization.

I met him first in 1894 when, as a Cambridge undergraduate, I attended his carefully prepared lectures on physical anthropology and ethnology. He had been then but recently attached for part of his time each year to the Department of Human Anatomy under Professor Alexander Macalister while retaining his Professorship in Dublin. I can still recall the powerful impression that he made on me, with his massive leonine head crowned with dense black hair, his piercing eyes, his curiously penetrating voice, his cheerful schoolboy-like manner, his sense of humour, and his forceful rapid flow of ideas.

In 1894 he published an elaborate memoir, the result of visits to many museums at home and abroad, entitled 'The decorative art of British New Guinea: a study in Papuan ethnography.' This important work was followed in the next year by a volume on 'Evolution in art, illustrated by the life-histories of designs,' dealing largely with the geographical distribution of art-patterns. He was one of the first to realize the value of the ethnological study of arts and crafts. Having in mind his own discoveries in New Guinea, he wrote: "Whereas the physical anthropologist can at present barely distinguish between the natives of contiguous districts, their art at once suggests distinctions, and then a fresh appeal has to be made to the physical anthropologist for a more searching investigation." Haddon was singularly well fitted to make such technological investigations his speciality: many have regretted that he did not do so. But his enthusiasm and wider interests, as an organizer of the whole of the young science of ethnology, led him irresistibly to research in many, indeed in nearly all, of the other branches of the subject.

Haddon became a great organizer, and also a great popularizer, of anthropology and ethnology. In 1898 I joined him in the Cambridge Anthropological Expedition to the Torres Straits and Sarawak, which he organized and led with conspicuous success. He had scant sympathy with the "arm-chair" ethnologist. "What is most needed," he then insisted, "is the intensive study of limited areas." The six quarto volumes of Reports of the Cambridge Anthropological Expedition to Torres Straits, and the memoirs of much other field-work since conducted by his pupils, attest the importance that he attached to this view.

On the return of this expedition to Cambridge he moved over from the Department of Anatomy to the wider field offered at the University Museum of Ethnology. This was in future his workshop, and he enriched it vastly. In 1900 he was appointed University Lecturer in Ethnology at Cambridge, and in the following year resigned his Professorship in Dublin. He was twice President of the Section of Anthropology of the British Association, President of the Royal Anthropological Institute, and of the Cambridge Antiquarian Society, and was Reader in Ethnology at Cambridge from 1909 to 1926. He played an important part in getting the Colonial Office to recognize the importance of ethnological

training for those who would later undertake administration among primitive people. His published books include 'The study of man' (1898), 'Head-hunters, black, white and brown' (1901), 'The races of man' (1909), 'A history of anthropology' (1910), and 'The wanderings of peoples' (1911), and lastly in 1935, jointly with Julian Huxley, the book 'We Europeans,' where the notion of race is exposed as "a myth, and a dangerous myth at that."

He retired from his Readership in 1926 at the age of seventy-one, but retained to the end of his life his energy, conspicuous vitality, and indomitable cheerfulness. His home was ever open to those who were interested in the field of ethnology. He infected not only his younger daughter but many others with the making of "cat's cradle" patterns brought back from New Guinea and elsewhere. Despite an inveterate tendency to confuse the popular and the scientific attitudes, Haddon was a successful fighter in the uphill struggle which a young science like anthropology has to face: the success of the Anthropological Tripos at Cambridge is sufficient evidence of this. C. S. MYERS.

ADMIRAL SIR GEORGE EGERTON, K.C.B.

Admiral Sir George Le Clerc Egerton, who died on 30 March 1940 at the age of eighty-seven, was the last surviving officer of Sir George Nares' Arctic Expedition of 1875–76.

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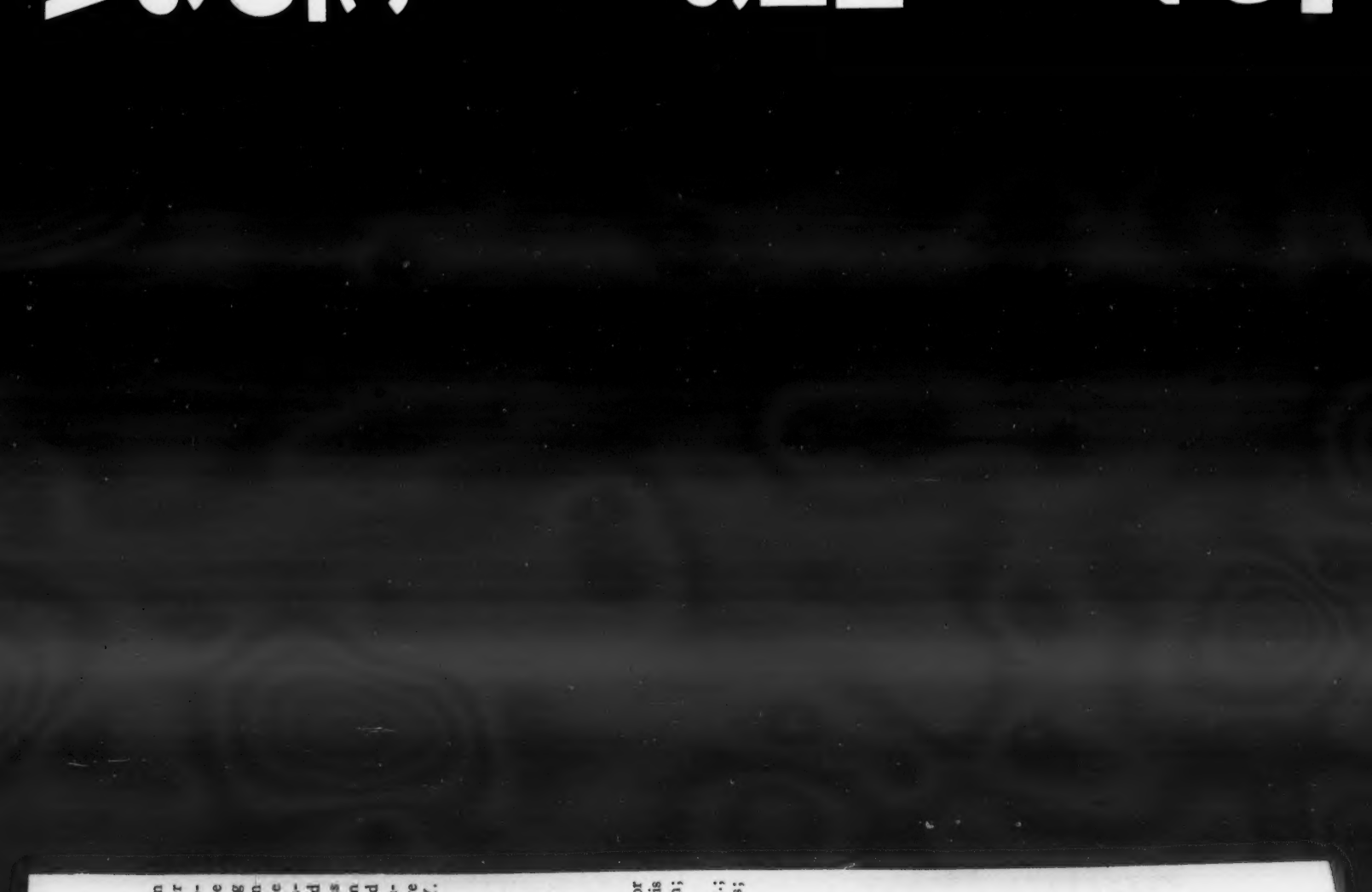
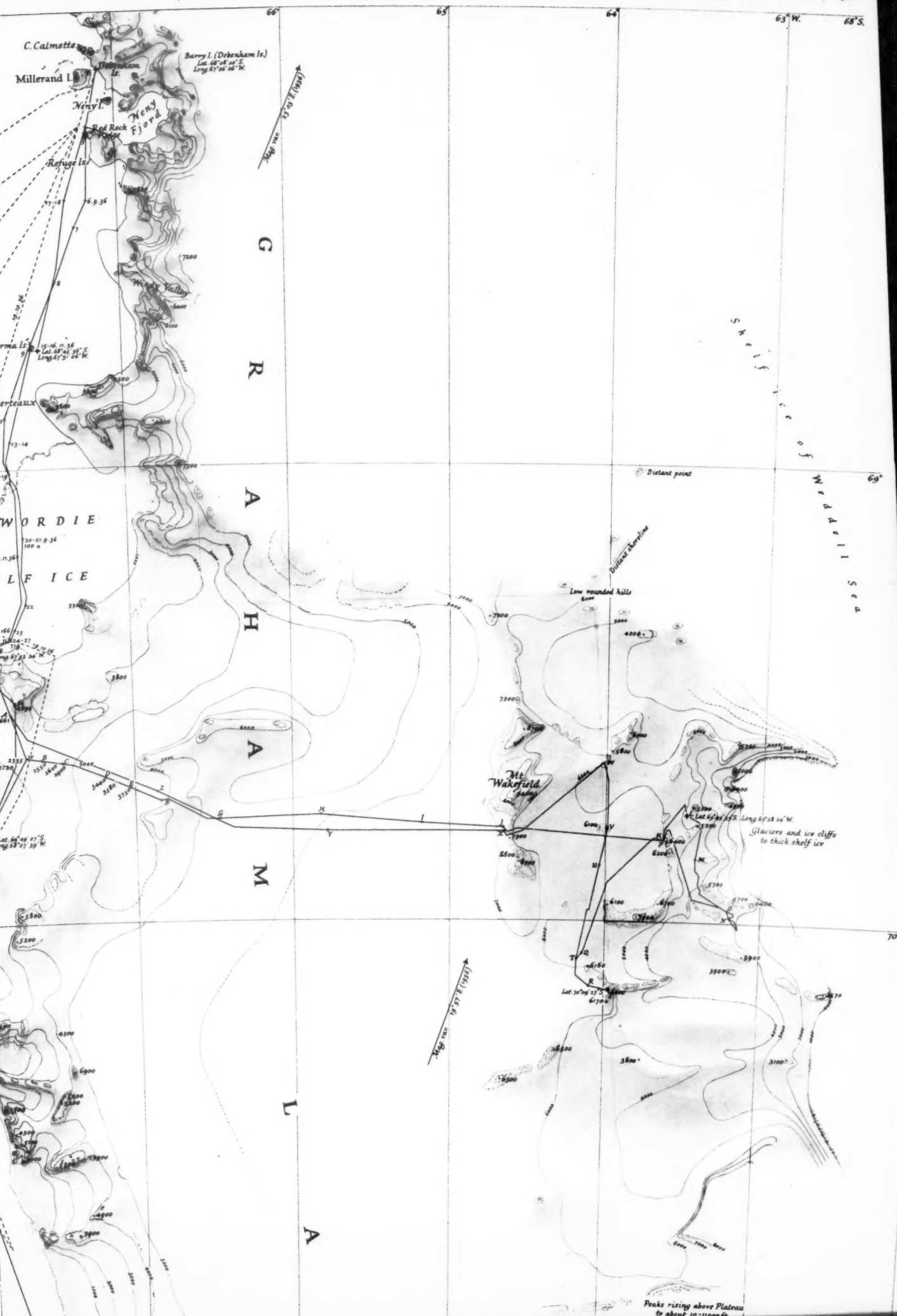
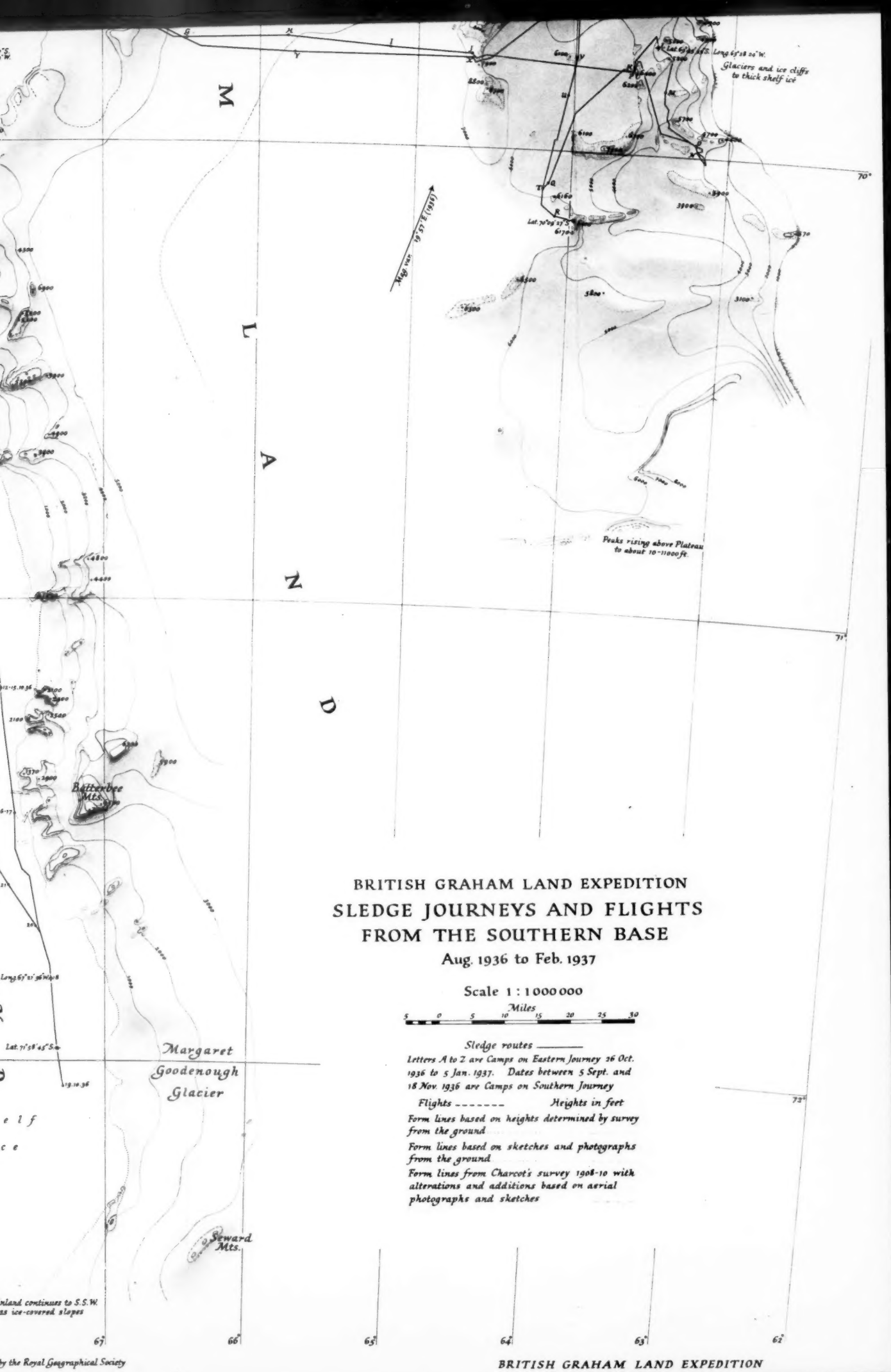


72° W.
71°
70°
69°
68°
C. Calm
Milleran
MARGUERITE BAY
Terra Firma Is.
C. Berteaux
Mushroom I.
Approximate edge of bay ice
Mt. Bayonne
Pas le Mt.
Rouen Mts.
C. Nicholas
Bay ice
WORD
SHELF I
Havre Mts.
Mt. Edgell
C. Jeremy
Mt. Rothschild
ALEXANDER I L
DOUGLAS RANGE
KING GEORGE
Shelf ice
Glacier ice merging into shelf ice
Ice covered ridge
Ablation Camp


66°
65°
64°
63° W.
68° S.
69°
70°
C. Calmette
Millerand I.
Barry I. (Debenham Is.)
Lat. 68°08·0′ S.
Long. 67°06·0′ W.
Debenham Is.
Neny I.
Neny Fjord
Red Rock Point
Refuge Is.
Mag. var. 33° 0′ E (1938)
Wright Valley
G R A H A M L A N D
Shelf Ice of Wordie Sea
Distant point
Distant shoreline
Low rounded hills
Mt. Wakefield
Lat. 69°28·5′ S. Long. 65°28·0′ W.
Glaciers and ice cliffs to thick shelf ice
Mag. var. 19° 57′ E (1938)
Lat. 70°09·2′ S.
Peaks rising above Plateau to about 10–11000 ft.

ALEXANDER I LAND
KING GEORGE VI SOUND
Shelf ice
Glacier ice merging into shelf ice
Ice covered ridge
High distant range
Ablation Camp
Fossil Camp
Alexander I Land appears to end in a distant icy point
Mainland continues to
as ice-covered slop
Published by the Royal Geogra
72°
73°
71°
70°
69°
68°



BRITISH GRAHAM LAND EXPEDITION

SLEDGE JOURNEYS AND FLIGHTS FROM THE SOUTHERN BASE

Aug. 1936 to Feb. 1937

Scale 1 : 1 000 000

Miles

5 0 5 10 15 20 25 30

Sledge routes ———

Letters A to Z are Camps on Eastern Journey 26 Oct. 1936 to 5 Jan. 1937. Dates between 5 Sept. and 18 Nov. 1936 are Camps on Southern Journey

Flights – – – – – – – *Heights in feet*

Form lines based on heights determined by survey from the ground

Form lines based on sketches and photographs from the ground

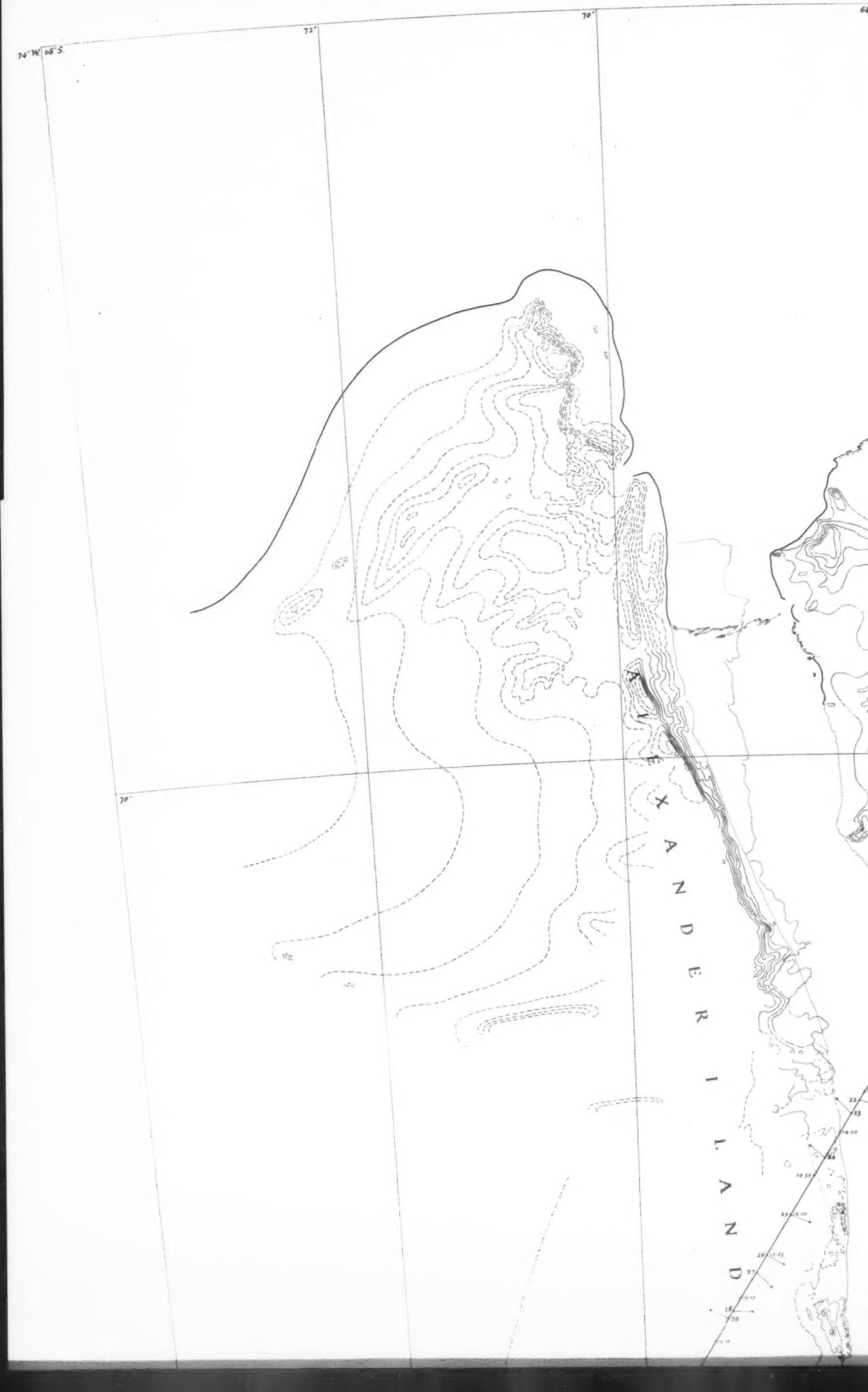
Form lines from Charcot's survey 1908-10 with alterations and additions based on aerial photographs and sketches

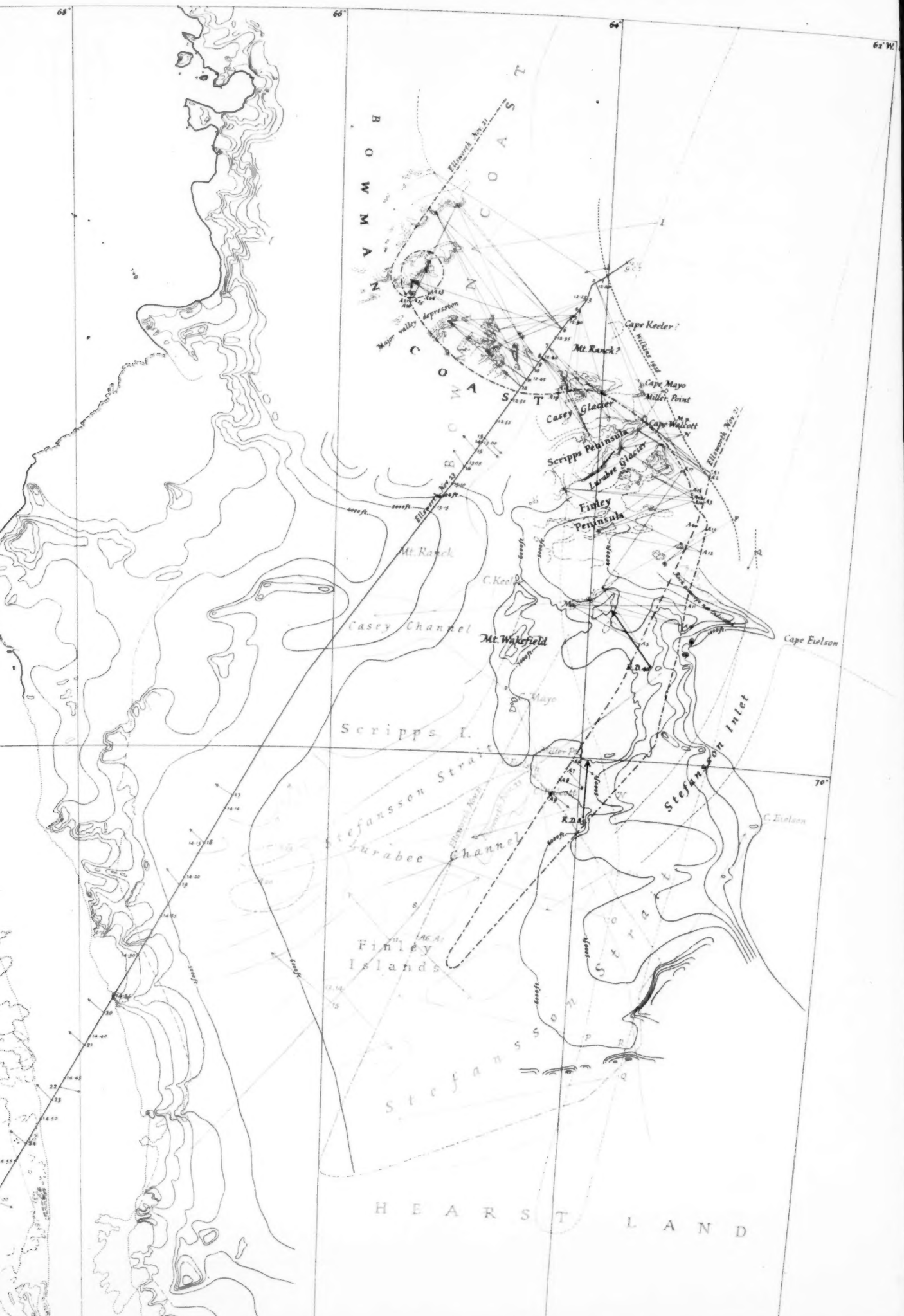
nland continues to S.S.W. as ice-covered slopes

by the Royal Geographical Society

BRITISH GRAHAM LAND EXPEDITION

Stephenson


74° W.
68° S.
72°
70°
70°
ALEXANDER ISLAND


68°
66°
64°
63° W.
70°
BOWMAN COAST
Ellsworth Mts
Major valley depression
Cape Keeler?
Mt. Ranck?
Williams Nunatak
Cape Mayo
Miller Point
Casey Glacier
Cape Walcott
Scripps Peninsula
Larabee Glacier
Finley Peninsula
Mt. Ranck
C. Keeler
Casey Channel
Mt. Wakefield
Cape Eielson
R.D.A.
Mayo
Scripps I.
Stefansson Strait
Larabee Channel
Stefansson Inlet
C. Eielson
Finley Islands
Stefansson Strait
HEARST LAND

N D E R I L A N D
72°
70°

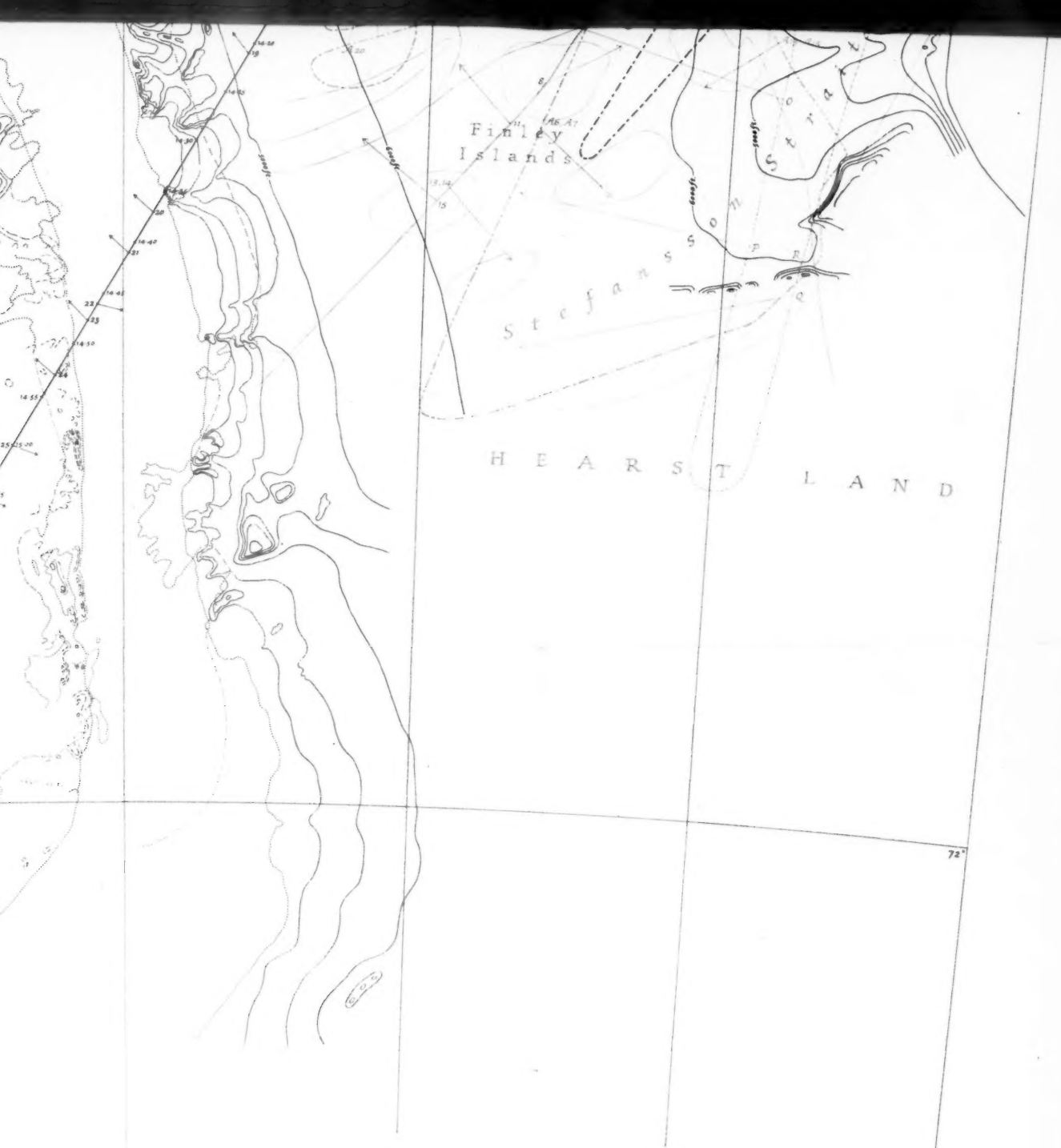


DIAGRAM RELATING THE DISCOVERIES OF WILKINS AND ELLSWORTH TO THOSE OF THE BRITISH GRAHAM LAND EXPEDITION

Wilkins' map based on his flight of 20 December 1928 (Geog. Rev. July 1929)

Wilkins' course replotted by Joerg (Geog. R. July 1937)

Ellsworth's flights of 21 and 23 Nov. 1935. Original plot by Joerg (Geog. Rev. July 1936)

Ellsworth's flights replotted by Joerg (Geog. Review July 1937) adjusted to the B.G.L.E. map

B.G.L.E. surveys

Miles

10 0 10 20 30 40

twilight as the *time* when the centre of the sun is 6° below the horizon, and nautical twilight as the *time* when it is 12° below. At sunset as above defined the unrefracted centre is then 50′ below the horizon and has to sink only 5° 10′ before the time assigned to civil twilight: so the intervals between the three tabulated phases are not equal. The Nautical Almanac considers that if the sun is much lower than 6° "ordinary outdoor civil occupations are impracticable without artificial light"; that civil twilight (not nautical) or some time near it, indicates the moment when the horizon ceases to be visible in a sextant; and that any given degree of indirect illumination (in the absence of moonlight) will always be associated with the same depression of the sun below the horizon. In all this it must be assumed that the sky is clear. The shortening of effective twilight caused by cloudy skies corresponds roughly to the distinction made by the Road Transport Act 1927 in the times of lighting up: half an hour after sunset when Summer Time is not normally in force, an hour when it is.

These rules take no account of the light of the night sky. On a bright starlit but moonless night one can see the main features of the landscape after a few minutes away from artificial light; and part of the light comes from permanent auroral glow.

In latitude 50° civil twilight lasts for 32 minutes at the equinoxes, 44 minutes at the summer solstice, and 38 minutes at the winter; in latitude 60° the durations are 43, 116, and 57 minutes. At the equator they are about 22 minutes at all seasons, and one may inquire why, according to the poet, and in general repute, there is no twilight in the tropics. "The Sun's rim dips, the stars rush out: at one stride comes the dark," said the Ancient Mariner. A few lines later he made a celebrated blunder about the moon, and was certainly no astronomer: but he expressed in defiance of arithmetic and the Nautical Almanac the view that the so-called civil twilight of 22 minutes instead of a few minutes over 30 (at the equinox) makes difference enough to justify the phrase "at one stride." If he was native of Shetland and thinking in the tropics of midsummer at home, the proportion 22 to 116 is more striking: yet hardly justifies the phrase "the stars rush out," at least according to Bravais, who wrote in 1850 from long observation, presumably in Paris, that he found first magnitude stars were not seen, even in the east, until the end of civil twilight defined as above. According again to Bravais, the "Crepuscular Curve or Twilight Bow," that is the border of the earth's shadow cast by the sun, reaches the zenith when the sun is down 6°, *i.e.* at civil twilight; and in clear tropical skies, with little dust in the air to scatter light, this would make the stars "rush out" in the eastern half of the sky as the shadow rises: an effect that we miss in our watery and dusty skies. Otherwise, there must be some psychological reason for the general feeling that there is practically no twilight in the tropics, or that dark comes very suddenly, which is not quite the same thing.

Nautical twilight might have been called naval twilight, for it is supposed to mark the end of the time in which there is or may be just enough light for handling and landing boats; the sea horizon for sextant observations has disappeared earlier, round about the time called civil twilight. But even astronomical twilight is not to be despised: clear nights in June are in our latitudes never really dark.

These questions of twilight have now more importance than usual; Wardens and Home Guards would find it interesting to note each evening the time when it is effectively dark enough to stay or permit certain operations, and so estimate the value and significance of these twilight tables first calculated for the Nautical Almanac for 1937, and summarized in Whitaker.

ADDITIONAL NOTE ON MR. JOERG'S INTERPRETATION OF THE ELLSWORTH PHOTOGRAPHS

On August 19, when the note on the 'Diagram relating the Discoveries . . .' (page 177) had already gone for page proof, we received Proceedings of the American Philosophical Society, Vol. 82, No. 5, containing the papers read at the Centenary Celebration and Symposium on American Polar Exploration held at Philadelphia on 23–24 February 1940. Among them is one by Mr. W. L. G. Joerg, "Demonstration of the Peninsularity of Palmer Land, Antarctica, through Ellsworth's flight of 1935." It has two figures, the first, "Air photographic survey by Ellsworth, Nov. 21 and 23, 1935. Published July 1937," based upon Joerg's Map A; the second, "Ground survey by Rymill expedition, Nov.–Dec. 1936. Published May 1938. As copied on Hydrogr. Office Chart 5411." The first has still no graticule; the second lies between 68° 50′ and 71° S. It is implied that Fig. 1 corresponds with the eastern half of Fig. 2, though on his Map D Joerg has tentatively placed his Map A between 68° 10′ and 69° 35′, a good deal farther north, which we have found very nearly right.

Chart 5411 was produced for the use of the United States Antarctic Service, and by the courtesy of the Hydrographer U.S.N. we had received a copy of it in January last. For Southern Graham Land it follows in general the B.G.L.E. map on 1/3,500,000 published in the *Journal* for May 1938, but to Rymill's unnamed cape in 69° 40′ S. the name Cape Keeler is assigned, and others of Wilkins' names to features west and south down to below 70° S. Moreover, spot heights in metres associated with these names on Joerg's Map A have been converted to feet and annexed to these features of Rymill's map. In his letter of 8 December 1939 accompanying the gift of the chart Captain G. S. Bryan explained that it had to be completed before his department had finished their researches, and that later information might change some of the names.

Now wherever Cape Keeler may be, it is at least north of Cape Mayo, and we have shown that the latter is just north of parallel 69° rather than in 69° 50′ S., as Chart 5411 shows it. It follows that all the names of Wilkins and the spot heights from Map A shown on Chart 5411 and on Joerg's Fig. 2 belong about 50′ farther north; and that Joerg has been mistaken in finding correspondence between his Air Survey from Ellsworth's photographs in his Fig. 1 and the Ground Survey of the B.G.L.E. copied into his Fig. 2. The first lies almost entirely north of the second, as he had shown on his Map D and we have shown on our Diagram.

A note to Figs. 1 and 2 suggests that had Rymill's map been available in 1937 the name Casey Glacier would have been applied in Map A and Fig. 1 to the Major Valley Depression; and that probably Cape Keeler (with Mount Ranck) and Cape Mayo should then have been placed at the north-western and south-eastern portals of Casey Glacier, as Wilkins placed them. We had come independently to a similar conclusion (see p. 180); but it requires that the portals shall be much farther east than they are shown on Map A.

Mr. Joerg suggests that the depression running east from the Wordie Shelf Ice, and lying to the north of Rymill's route to the eastern coast, is Wilkins' Casey Channel; but the latter is now shown to be 50 miles farther north. Only its entrance is shown on Map A; no photograph looks up it, and only E.15 and E.16 across it in cloud from 20 miles away. We do not think it possible to say that Ellsworth's photographs tell us anything of its level. Ellsworth logged it as Stefansson Strait. Kenyon radioed "Looks a channel O.K." Rymill proved that no channel comes out anywhere in that latitude on the west coast. Without that proof we do not think that there is anything like a "demonstration of the peninsularity."

A. R. H.

OBITUARY

DOCTOR ALFRED CORT HADDON, F.R.S.

Doctor Alfred Cort Haddon, who died last April in Cambridge at the age of nearly eighty-five, was educated at Christ's College, Cambridge, and was from 1880 to 1901 Professor of Zoology at the Royal College of Science in Dublin. In 1888 he paid an eight months' visit to the Torres Straits to study coral reefs and marine zoology; it was this visit that changed his future interests and activities. In his spare time he collected information from the islanders of the Straits about their folk-lore, ceremonies, and beliefs, and thus he came to realize the importance of rescuing such fast-perishing knowledge from the older natives in the face of advancing civilization.

I met him first in 1894 when, as a Cambridge undergraduate, I attended his carefully prepared lectures on physical anthropology and ethnology. He had been then but recently attached for part of his time each year to the Department of Human Anatomy under Professor Alexander Macalister while retaining his Professorship in Dublin. I can still recall the powerful impression that he made on me, with his massive leonine head crowned with dense black hair, his piercing eyes, his curiously penetrating voice, his cheerful schoolboy-like manner, his sense of humour, and his forceful rapid flow of ideas.

In 1894 he published an elaborate memoir, the result of visits to many museums at home and abroad, entitled 'The decorative art of British New Guinea: a study in Papuan ethnography.' This important work was followed in the next year by a volume on 'Evolution in art, illustrated by the life-histories of designs,' dealing largely with the geographical distribution of art-patterns. He was one of the first to realize the value of the ethnological study of arts and crafts. Having in mind his own discoveries in New Guinea, he wrote: "Whereas the physical anthropologist can at present barely distinguish between the natives of contiguous districts, their art at once suggests distinctions, and then a fresh appeal has to be made to the physical anthropologist for a more searching investigation." Haddon was singularly well fitted to make such technological investigations his speciality: many have regretted that he did not do so. But his enthusiasm and wider interests, as an organizer of the whole of the young science of ethnology, led him irresistibly to research in many, indeed in nearly all, of the other branches of the subject.

Haddon became a great organizer, and also a great popularizer, of anthropology and ethnology. In 1898 I joined him in the Cambridge Anthropological Expedition to the Torres Straits and Sarawak, which he organized and led with conspicuous success. He had scant sympathy with the "arm-chair" ethnologist. "What is most needed," he then insisted, "is the intensive study of limited areas." The six quarto volumes of Reports of the Cambridge Anthropological Expedition to Torres Straits, and the memoirs of much other field-work since conducted by his pupils, attest the importance that he attached to this view.

On the return of this expedition to Cambridge he moved over from the Department of Anatomy to the wider field offered at the University Museum of Ethnology. This was in future his workshop, and he enriched it vastly. In 1900 he was appointed University Lecturer in Ethnology at Cambridge, and in the following year resigned his Professorship in Dublin. He was twice President of the Section of Anthropology of the British Association, President of the Royal Anthropological Institute, and of the Cambridge Antiquarian Society, and was Reader in Ethnology at Cambridge from 1909 to 1926. He played an important part in getting the Colonial Office to recognize the importance of ethnological

training for those who would later undertake administration among primitive people. His published books include 'The study of man' (1898), 'Head-hunters, black, white and brown' (1901), 'The races of man' (1909), 'A history of anthropology' (1910), and 'The wanderings of peoples' (1911), and lastly in 1935, jointly with Julian Huxley, the book 'We Europeans,' where the notion of race is exposed as "a myth, and a dangerous myth at that."

He retired from his Readership in 1926 at the age of seventy-one, but retained to the end of his life his energy, conspicuous vitality, and indomitable cheerfulness. His home was ever open to those who were interested in the field of ethnology. He infected not only his younger daughter but many others with the making of "cat's cradle" patterns brought back from New Guinea and elsewhere. Despite an inveterate tendency to confuse the popular and the scientific attitudes, Haddon was a successful fighter in the uphill struggle which a young science like anthropology has to face: the success of the Anthropological Tripos at Cambridge is sufficient evidence of this. C. S. MYERS.

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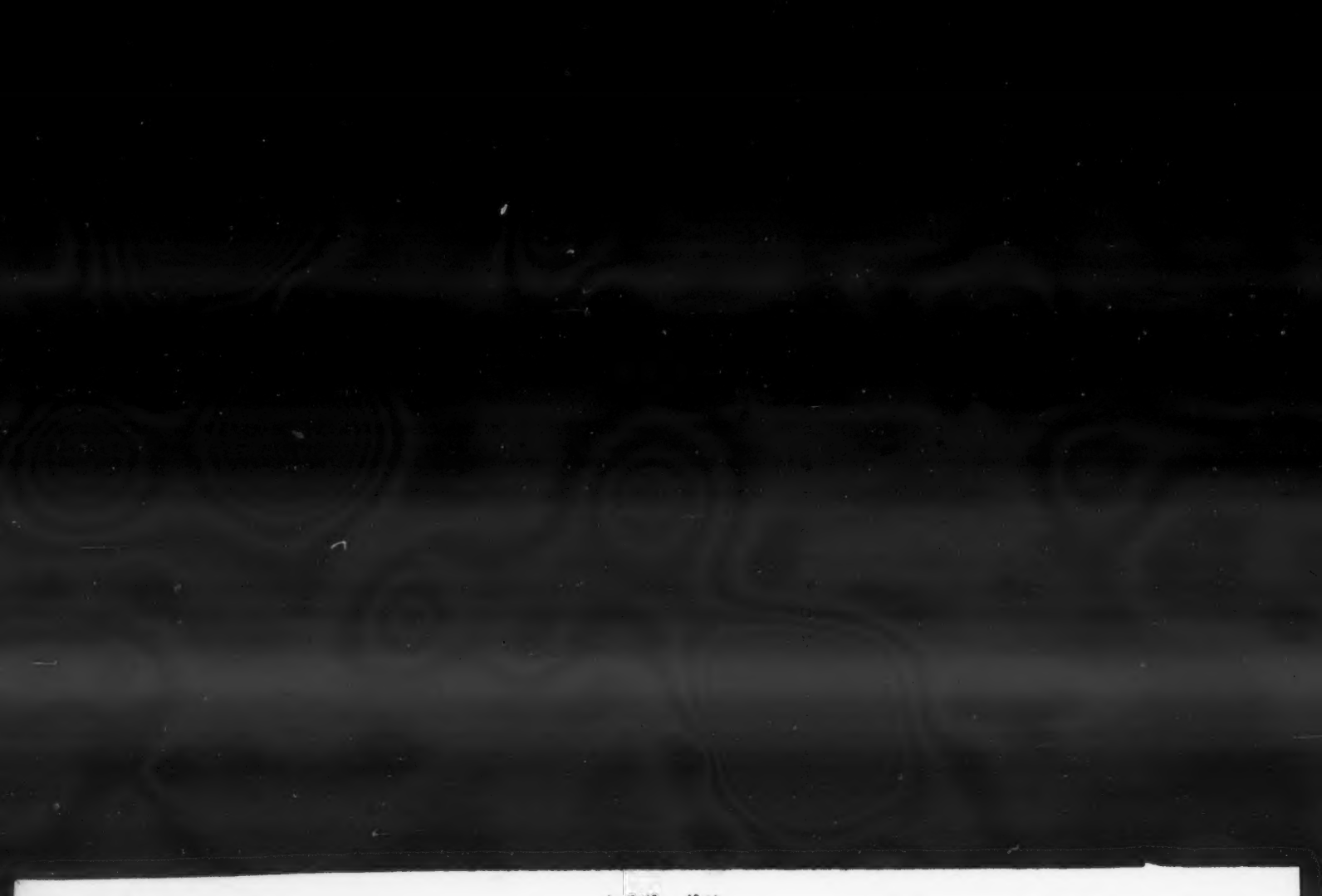
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